Novel interventions for increasing fruit and vegetable consumption in the workplace

By Zara Borgonha

A thesis submitted to the Faculty of Science and Technology, Bournemouth University in partial fulfilment of the requirements for the degree of

Masters of Research

in

Psychology

Bournemouth, UK

July 2018.

Novel interventions for increasing fruit and vegetable consumption in the workplace

By Zara Borgonha

Abstract

Background – Low fruit and vegetable (FV) consumption has been observed in varied age ranges. Past research supports the use of the workplace to test healthy eating interventions. Past research also suggests increased self-efficacy and a game-based approach may be advantageous to increase FV intake. The present study comprised 3 studies. Study 1 tested a poster intervention in 9 workplace canteens; study 2 tested novel health promotion posters on university students; study 3 tested the feasibility of a health promotion game.

Methods and results- Study 1- FV sales data were collected from 9 workplace canteens over a 4-week period (baseline, intervention and two weeks post-intervention). A health promotion poster was displayed for one week. Effects were observed for two weeks after. Promotion of FV to improve "current" outcomes, "appearance-based outcomes" and using "1 extra portion" were most successful.

Study 2- Health promotion posters using the phrase "you can" (to target self-efficacy) were tested on 97 students from Bournemouth university (12 males; aged 18-67 years, SD=6.15, 69.2% British). FV self-efficacy significantly predicted intentions but not intake.

Study 3 – 32 participants (4 males; aged 19-28 years, 84.5% British) completed a health promotion game. FV knowledge and consumption were measured as dependent variables. Knowledge significantly increased 1 week after game playing. A general measurement of FV intake before game playing indicated low levels. However, a specific measurement of FV intake suggested high levels one week after game playing.

Discussion – Results are discussed in terms of cognitive processing of manageable goals. Habits are an important factor that may have contributed to findings observed in study 1. Explicit address of self-efficacy may be the most efficient way to achieve self-efficacy levels that are sufficient to transform intentions into behaviour. Finally, real-world scenarios incorporated into health promotion games may be important contributors to knowledge increase.

TABLE OF CONTENTS Page

LIST OF FIGURES PAGE

LIST OF TABLES PAGE

APPENDICES PAGE

Acknowledgements

Firstly, I would like to thank the Department of Psychology at Bournemouth University for offering a Scholarship for the present project. This has enabled me to further my psychological studies in an important area of research, and to develop my research skills in an area I am passionate about. Secondly, I would like to acknowledge all the institutions where I was able to carry out this project. For this I am very grateful. I would also like to thank my supervisor Katherine Appleton for supervising the present project and providing me with essential help and advice throughout.

1. Introduction

1.1 Benefits of fruits and vegetables

A diet that incorporates increased fruits and vegetables (FV) is associated with many beneficial health outcomes such as increased mental well-being (McMartin, Jacka & Colman, 2013), a broad range of wellbeing states (Conner, Brookie, Richardson & Polak, 2015) happiness and life satisfaction (Mujcic & Oswald, 2016), decreased obesity (Slavin & Lloyd, 2012) and decreased cardiovascular disease (Alissa, Eman, Ferns & Gordon, 2017). Similar health outcomes have also been observed in meta-analytic and systematic review approaches (Wang, Ouyang, Liu, Zhu, Zhao, Bao & Hu, 2014; Aune et al, 2017).

1.2 Consumption rates

Current recommendations by the World Health Organization advise a daily consumption of at least five portions of FV to deter negative health. However, research has confirmed that consumption rates are not as high as recommendations in a variety of age ranges (e.g. El Ansari et al, 2011; Teschl, Nössler, Schneider, Carlsohn & Lührmann, 2018; Appleton, Krumplevska, Smith, Rooney, McKinley & Woodside, 2017; Dijkstra, Neter, Brouwer, Huisman, Visser, van Lenthe & Kamphuis, 2018). Such findings emphasize the importance of effective healthy eating interventions to reach widespread ages.

1.3 The workplace

According to the Organisation for Economic Co-operation and Development (OECD, 2018), the average person in the United Kingdom spent 1676 hours at work in 2016. The workplace provides ease of access for a wide breadth of populations which suggests it would be an effective location to apply healthy eating interventions. Moreover, high percentages of employees use their staff canteen (Engbers, van Poppel, Paw & van Mechelen, 2006; Winston, Johnson & Wilson, 2008). Dawson, Dwyer, Evers & Sheeshka, (2006) identified that 69% of respondents of a healthy eating hospital cafeteria intervention bought one to five meals or snacks in their workplace canteen in a seven-day week. Identifying successful workplace interventions that improve health behaviors is important at both individual and organizational levels as workplace costs include absenteeism and presenteeism.
Seymour, Lazarus Yaroch, Serdula, Blanck & Khan (2004), in a review of nutrition environmental interventions, suggest that worksite and university locations have the most

potential for success (as opposed to grocery stores). This practical conclusion was reached due to the availability of onsite eating establishments in such institutions. Furthermore, much consumption of daily calories takes place during working hours (Katz et al, 2005). Employers' interest in the health of their employees is also advantageous for their organization. Research regarding employees' perceptions of employers' interest in their health has obtained positive findings related to feelings of value (Hammerback, Hannon, Harris, Clegg-Thorp, Kohn & Parrish, 2015).

Findings regarding food choices at the workplace are mixed. Using data from Finland, Raulio, Roos & Prättälä (2010) identified that healthier food choices were made by individuals who ate at a workplace canteen. However, Orfanos et al (2007), using data from 10 European countries, identified decreased vegetable consumption out of the house. Such findings may be more valid due to the variety of countries that formed the sample. Similar findings also demonstrate that 9^{th}-12^{th} grade students in Georgia consume healthier foods at home (Kumar, Bryan, Bayakly, Drenzek, Merlo & Perry, 2017).

The efficacy of workplace interventions has been demonstrated in regards to nutrition knowledge (Cook, Swinburn & Stewart, 2001), fruit and/or vegetable intake (Cook, Swinburn & Stewart, 2001; Campbell, Tessaro, DeVellis, Benedict, Kelsey, Belton & Sanhueza, 2002; Sternfeld et al, 2009; Quintiliani, Poulsen & Sorensen, 2010; Bandoni, Sarno & Jaime, 2011), positive, short-term benefits (Holdsworth & Haslam, 2004), dietary behaviour (Schröer, Haupt & Pieper, 2013; Bull, Dombrowski, McCleary & Johnston, 2014), mindful eating (Stites et al, 2015), BMI (Geaney, Kelly, Marrazzo, Harrington Fitzgerald,Greiner & Perry, 2016), weight loss (Morgan, Collins, Plotnikoff, Cook, Berthon Mitchell & Callister, 2011) and total sugar, total fat, saturated fat and salt intakes (Geaney, Harrington, Fitzgerald & Perry, 2011). Such research supports use of the workplace canteen as a location for healthy eating interventions.

1.4 Health promotion posters

Due to the large numbers of people that use workplace canteens, it is essential to use an effective means of communication to target this population. Health promotion posters typically provide a reason why engaging in particular behaviours is beneficial (e.g. exercise to keep fit). A poster intervention is cost-effective, easy to implement, flexible and versatile. Such posters have been effective in regards to behavioural intentions (Mackert et al, 2014),

stair use (Russel,l Dzewaltowski & Ryan, 1999; Iversen, Händel, Jensen, Frederiksen & Heitmann, 2007), influenza vaccine uptake (Qureshi, Hughes, Murphy & Primrose, 2004) increasing knowledge regarding management of traumatic dental injuries (Ghadimi, Bahman, Hooman, Ahmad Reza & Razieh, 2014), in GP waiting rooms (Ward & Hawthorne, 1994) and at vending machines (Stöckli, Stämpfli, Messner & Brunner, 2016).

1.5 The mere exposure effect

Health promotion posters rely on two premises in order to be successful. The first, the mere exposure effect, implies that the more often an individual is exposed to something, the more they will be influenced by it (Zajonc, 1968). Early research by Gorn & Goldberg (1982) suggests that exposure, achieved from viewing a poster in a popular location, may influence behaviour early in life. In this research daily exposures to televised messages about candy resulted in increased candy consumption for five to eight-year olds. If individuals are exposed to similar poster messages in workplace canteens it could be inferred that consumption of the target food could be increased. Relationships between food advertising exposure and intake have also been observed for 5- 12-year-olds (Jones & Kervin, 2011), 8-21-year-olds (Giese et al, 2015) and 12-17-year-olds (Scully et al, 2012). Similar findings have also been observed in regard to verbal messages. Schwartz (2007) investigated the effects of verbal messages from cafeteria staff to elementary school students. In the school intervention, cafeteria staff were instructed to verbally prompt children while they were standing in front of the fruit at the cafeteria. Cafeteria staff asked children "Would you like fruit or juice?" In the control school, 40% of children consumed fruit at lunch, whereas, close to 70% of children in the intervention school consumed a fruit serving at lunch. Similar effects are also evident in older individuals. Linnan, Ferguson, Wasilewski, Lee, Yang, Solomon & Katz (2005), via a community based participatory approach, demonstrated the impact of cancer- prevention conversations between cosmetologists and their clients. During this pilot study, findings demonstrated that cosmetologists engaging in health promotion conversations with their clients, resulted in positive health changes. Both studies highlight the effects of exposure in strictly verbal capacities. However, verbal messages may be less efficacious in workplace settings. Firstly, in comparison to children, workers may be less susceptible to verbal influences. In school settings children may, at times, demonstrate an acquiescence bias. In the study by Linnan et al (2005) the majority of participants were aged 34 or older. Salons provide a relaxing atmosphere and salon treatments are a choice rather than a necessity (as

opposed to school). Therefore, it could be inferred that responses in such establishments may be more authentic.

1.6 Knowledge of recommendations

As previously discussed, current recommendations regarding daily FV consumption are not being met. Many campaigns have been developed to create memorable and engaging messages with the aim of increasing intake. Past research has identified low knowledge of the five a day message (Rooney et al, 2017) and relationships between knowledge and consumption (Wolf, Lepore, Vandergrift, Wetmore-Arkader, McGinty, Pietrzak & Yaroch, 2008; Erinosho, Moser, Oh, Nebeling & Yaroch, 2012; Colón-Ramos, Finney Rutten, Moser, Colón-Lopez, Ortiz & Yaroch, 2015; Appleton et al, 2018) which suggests different strategies are required. Qualitative research in a factory-based workplace in Nepal identified that choosing healthy foods was influenced by personal knowledge and attitudes (Shrestha et al 2017). As previously discussed, the workplace is a suitable location to test novel interventions.

1.7 Gradual recommendations

Encouragement of gradual recommendations (e.g. one more portion of FV as opposed to 5 portions) may be more efficacious in the workplace environment. Past research has observed high levels of intent to improve FV consumption (Luszczynska, Tryburcy & Schwarzer, 2007). However, individuals may perceive health promotion communications that encourage a daily consumption of 5 FV too difficult. Sieverding & Scheiter (2012) identified that the desired FV consumption of students was less than recommendations. Encouragement of gradual recommendations may be more effective at prompting individuals to make dietary changes and sustain them. Ungar, Sieverding & Stadnitski (2013) compared the effects of personal instruction encouraging "just one more" portion of FV to messages encouraging participants to eat "5 a day". In this randomized controlled intervention study FV intake was measured at three time points; before the intervention via a questionnaire, during the intervention via a food diary, and one week after the intervention via a questionnaire. Findings of this study refute the efficacy of messages promoting consumption of "just one more" portion of FV. For low consumers of FV the "5 a day" message was more successful. At the last measurement point one week after the intervention, participants in all groups ate more FV than at baseline; however, those instructed to eat "5 a day" had a significantly higher FV intake than the control group.

However, some methodological aspects of this study could be explored in further research. Firstly, a student sample (84 participants) formed the population. Using a workplace sample may produce different findings. Secondly, poster messages, as opposed to verbal instruction may have also influence results. Ungar, Sieverding & Stadnitski (2013) only included participants that consumed less than 4 daily servings of FV at baseline in their analyses. Their rationale for this decision was that the "5 a day" message would be equal to the "just one more" message for those consuming 4 daily servings of FV at baseline. However, for those who consume 4 FV encouragement of eating "just one more" may better influence them to increase their consumption to 5 FV. Similarly, later research by Ungar, Sieverding, Schweizer & Stadnitski (2015) also found no evidence for the efficacy of encouragement of "1 more portion" compared to "5 portions" on subsequent intake. Such research by Ungar, Sieverding & Stadnitski (2013) and Ungar et al (2015), however, only instructed participants on how much to consume and did not provide a reason to engage participants in such behaviour. Providing a reason as to *why* they should consume these FV portions may have positively influenced results in both studies. Participants may have been more likely to change their consumption if they were provided with a reason as to *why* they should (e.g. for their body weight/ health). Acknowledgement of the effects of advertising that includes the outcomes of healthy behaviours has been observed in children as young as 7 years (Hesketh, Waters, Green, Salmon & Williams, 2005). Therefore, communicating such outcomes would be advantageous for adults who can further understand the reasons provided for FV consumption.

Furthermore, low FV consumers often cite convenience as an important factor in regard to food choice (Pollard, Greenwood, Kirk & Cade, 2002). This suggests that convenience needs to be targeted in healthy eating communications. Although convenience can be addressed via easy and quick recipes for eating at home (Pollard et al, 2002), such efforts would not be efficacious at the workplace. Use of the phrase "1 extra" could be perceived as a convenient food goal as opposed to "5 portions of fruit and vegetables". Convenience food is often purchased because it is quick and easy. Therefore, such individuals whose food choices are driven by convenience could perceive fruit and/or vegetables as a convenient option if it is labelled as one via the phrase "just one more". Also in relation to convenience, is response to the time-based outcome of FV promotion. Promotion of FV to improve "current" health/ appearance as opposed to "future" based outcomes may be perceived as a more manageable, achievable and convenient goal. Preferences for short-term messages (which also promoted

an appearance-based outcome of increased FV) have been observed by Satia, Barlow, Armstrong-Brown & Watters (2010). This finding supports the efficacy of promotion of appearance-based and "current" outcomes separately.

1.8 Poster messages

The second element of a poster which determines its success, is its underlying message; the wording of which is important to increase the probability of achieving desired outcomes. Targeted and simple messages have been recommended in early research examining point-of-choice nutrition labelling schemes in the workplace, public eating places and universities (Holdsworth & Haslam, 1998). Furthermore, health-benefit messages and weight-control messages have both been found to be effective in regard to stair use (Andersen, Franckowiak, Snyder, Bartlett & Fontaine, 1998). Findings of such studies in the physical activity literature could be utilized in healthy eating research, as health-benefit and weight-control messages are applicable in both areas of health research.

In an exploration of demographic, psychographic and communicative variables, Dutta-Bergman (2004) identified that healthy eaters were environmentally conscious and health-oriented with an information orientation. Informational-based messages provide information as a basis for their persuasion and can be manipulated to emphasize specific factors (e.g. health, nutrition, appearance, social norms). Such findings from Dutta-Bergman (2004) can be utilized via providing information as to *why* a particular food is healthy (e.g. via nutritional information), and/or being specific as to *what* it is beneficial for (e.g. appearance, health). Encouraging people to eat more FV to achieve particular goals may be more advantageous than saying "eat fruit and vegetables". Individuals are unlikely to adhere to written communications if there is a not a reason to engage in recommended behaviour.

1.9 Appearance-based messages

Appearance-based messages provide information regarding how particular foods can impact appearance-based factors such as body weight and shape. Research has identified equal prevalence of appearance and health-framed women's health magazines (Aubrey, 2010). This may suggest that some individuals may be motivated to engage in health-promoting behaviour to improve appearance in comparison to health. In comparison to nutrition-based information, posters that communicated appearance-based outcomes of eating FV have been linked to increased immediate fruit selection (Appleton, 2016). Appearance-based motivators have been found to influence food choice in young adult males (Ashton, Hutchesson, Rollo,

Morgan, Thompson & Collins, 2015), women aged 35-69 (Pollard et al, 2002) and 9th- 12th grade students in Georgia (Kumar et al, 2017). Moreover, appearance-related motivations to lose weight are also more common for young adults compared to their older counterparts (LaRose, Leahey, Hill & Wing, 2013).

Linnan et al (2005) examined the effects of an intervention that involved health promotion conversations between cosmetologists and their clients. An example of a topic used in such discussions regarded maintaining a healthy weight. In a 12-month follow-up questionnaire 82.2% of customers who reported engagement in such conversations with their cosmetologist also reported an increased readiness to maintain a healthy weight. At follow-up, 70.9% of respondents also reported a daily consumption of at least five FV since participation in the study. As such findings were obtained in an appearance-motivated environment with a cosmetologist, this may indicate that adults are driven to maintain a healthy weight by appearance-based motivators. Moreover, engaging in conversations (in a comfortable environment) about health may also have implications related to self-esteem and self-efficacy (discussed in section 12).

As discussed, research has obtained positive results concerning the use of appearance-based messages regarding FV. There are a number of factors that could explain the efficacy of appearance-based messages on FV intake. Firstly, some individuals may be motivated by appearance-based factors due to their weight status. Secondly, dietary motivations related to appearance may originate from social media exposure. Social media may heighten and/or blur concerns and/or interests in appearance-based factors. Meta-analytic research by Grabe, Ward & Hyde (2008) demonstrated links between thin-ideal body images in the media and female body image concerns. Furthermore, such exposure has increased due to the development of social media in the 21st century. Photo-based applications such as Instagram and the social networking application Facebook could enhance appearance-related concerns. Cohen, Newton-John & Slater (2017) identified that appearance-focused use of sites such as Instagram and Facebook coincided with body image worries in young women. In regards to men, mass media pressure (in relation to muscular "ideal" male bodies) has been found to be linked to body satisfaction, body esteem, self-esteem and psychological disorders (Barlett, Vowels & Saucier, 2008). Moreover, encouragement of FV consumption to look after current as opposed to future body weight or health may also be perceived as a more manageable goal.

1.10 Health-related messages

The desire to be healthy has often been reported as the main motivator to eat healthily (Pollard et al, 2002; Kumar et al, 2017; Ashton, Hutchesson, Rollo, Morgan & Collins, 2017; Munt, Partridge & Allman- Farinelli, 2017). Greater concern about health has also been identified as a longitudinal predictor of higher FV intake in young adulthood (Larson, Laska, Story & Neumark-Sztainer, 2002). Therefore, including the outcomes of engaging in healthy behaviour (via health-based messages) may increase the effectiveness of healthy eating interventions. In regards to food messages, preferences for health-based messages have been identified in comparison to taste-based messages (Zandstra, Carvalho & van Herpen, 2017).

1.11 Motivation

Motivation simply refers to what drives behaviour (i.e. the reasons for behaviour) (Gorman, 2004). Identifying motivations for healthy eating is advantageous to plan targets of heathy eating communications. A differentiation can be made between intrinsic and extrinsic motivation. Intrinsic motivation refers to motivations driven by internal rewards (e.g. positive feelings), whereas external motivation refers to motivation that is driven by external rewards (e.g. money, fame). Such motivations may both be sub-conscious or conscious.

Motivation has been identified as an important factor in regards to student's FV consumption (Evans, Kawabata & Thomas, 2015). More specifically, eating healthily has been found to be strongly associated with intrinsic motivation (e.g. to feel better) (Trudeau, Kristal, Li & Patterson, 1998; Eikenberry & Smith, 2004). Extrinsic motivation may be less applicable to healthy eating. As previously discussed, healthy eating can be driven by appearance-related motivators such as body weight and shape. Although possible, such appearance-related motivators may be extrinsically driven (e.g. to receive praise from others, money). However, for the majority of individuals, appearance-related motivators may be intrinsically driven (e.g. to increase confidence, satisfaction). Therefore, it may be more advantageous to address intrinsic motivation in health promotion communications.

Workplace research by Shrestha et al (2017) identified that workers perceived difficulty in changing eating habits as a barrier to healthy eating. Lack of motivation has previously been cited as a perceived barrier to healthy eating for different ages and populations (Hearty, McCarthy, Kearney & Gibney, 2007; LaCaille, Nichols Dauner, Krambeer & Pedersen, 2011; Musaiger et al, 2013; Payán, Sloane, Illum, Farris & Lewis, 2017; Munt, Partridge & Allman-Farinelli, 2017). Increased motivation leads to increased attention and comprehension of

applicable information (Dutta-Bergman, 2004). People are unlikely to engage in particular behaviours if they do not possess any motivation to do so. Will power, which bears similarities to motivation, has been found to be a facilitator for healthy eating in 11-16-year-olds (Shepherd, Harden, Rees, Brunton, Garcia, Oliver & Oakley, 2001). However, some individuals may lack the capability to carry out particular behaviours due to subjective constructs such as self-esteem and self-efficacy acting as inhibitors to positive health behaviour.

1.12 Self-esteem and self-efficacy

Self-efficacy refers to judgements regarding an individual's own ability to carry out particular behaviours successfully to produce desired outcomes (Bandura, 1977). Self-efficacy has been found to be consistently related to dietary behaviour change (Cerin, Barnett & Baranowski, 2009, Luszczynska, Horodyska, Zarychta, Liszewska, Knoll & Scholz, 2016). Positive associations between self-efficacy and FV consumption have also been observed (Fernández, Warner, Knoll, Montenegro, Montenegro & Schwarzer, 2015; Blake & Patterson, 2015; Odum, Housman, Williams, Bishop & Burson, 2016; Kushida, Iriyama, Murayama, Saito & Yoshita, 2017). Self-efficacy has also been identified as a predictor of FV consumption in a review of research on adults (Shaikh, Yaroch, Nebeling, Yeh & Resnicow, 2008) and for university students (Tassitano, Martins, Cabral, Mota, Tenorio & Silva, 2016). More specifically, higher self-efficacy for healthy eating has been demonstrated in conjunction with healthy food intake (Gebremarim, Henjum, Terragni & Torheim, 2016; Fitzgerald, Heary, Kelly, Nixon & Shevlin, 2013) and as a predictor of vegetable intake (Larson et al, 2012).

In research by Luszczynska, Tryburcy & Schwarzer (2006), a nutrition intervention specifically targeted self-efficacy to produce desired effects. In this study, participants in the "self-efficacy" intervention group were provided information about the importance of self-efficacy and its role in nutrition change behaviour, the consequences of high levels of self-efficacy, feedback in response to participants' self-efficacy scores and strategies to increase self-efficacy. Results demonstrated that the "self-efficacy" intervention was successful and produced increased consumption levels 6 months post-intervention. Such findings demonstrate that both being self-efficacious and having an awareness of self-efficacy is important in regards to healthy eating. This suggests that targeted language that addresses self-efficacy is important to encourage positive health behaviour.

Self-esteem, on the other hand, refers to global self-worth i.e. how positively or negatively a person feels about themselves (Rosenberg, 1965). Links between high self-esteem and health-promoting behaviours have also been observed. McGee and Williams (2000) identified global self-esteem as a predictor of negative health behaviours (including problem eating) in adolescents. Similarly, Franko, Cousineau, Rodgers, Roehrig & Hoffman (2013) identified self-esteem as a predictor of FV consumption. Parallel findings demonstrating the presence of high self-esteem in conjunction with healthy behaviours have also been observed in different age ranges (Lucas, Orshan & Cook, 2000; Huntsinger & Luecken, 2004; Sok & Yun, 2011). Using a focus group approach, Tiedje et al, (2014) identified that healthy eating was perceived as advantageous for confidence and self-esteem. In college students Fielder-Jenks (2010) identified that health being the primary motivation for food and exercise predicted higher self-esteem. Such findings illustrate a cycle that suggests a certain degree of self-esteem is necessary to engage in positive health behaviours (such as healthy eating). Then, engaging in such positive health behaviour (as a result of a particular level of self-efficacy) results in increased levels of self-esteem and self-efficacy. However, due to particular events etc. the positive health behaviour may not be maintained, which starts the cycle again. Such findings illustrate a covert and overt valuation of oneself via positive health behaviours.

Such research regarding self-esteem and self-efficacy suggests that a sense of worth is essential regarding perceptions of ability to carry out health-promoting behaviours. Targeting self-efficacy and self-esteem could achieve a sense of empowerment advantageous for positive health behaviour. Research on healthy eating has also been carried out in regards to self-affirmation (which could also produce feelings of empowerment). Self-affirmation refers to an assessment of values that an individual perceives as important to them (Van Koningsbruggen, Harris, Smits, Schüz, Scholz & Cooke, 2016). In research by Van Koningsbruggen et al (2016) individuals that were induced to experience self-affirmation before reading a healthy eating message about the benefits of FV increased intentions to eat recommended daily servings of FV. In this study consumption correlated with intentions for self-affirmed participants. The authors discuss such findings via increased anticipated regret which was also observed for self-affirmed participants. Van Koningsbruggen et al (2016) note the time-consuming nature of the self-affirming manipulation in their study. However, use of the phrase “you can” could indirectly induce self-affirmation. Such research by Van Koningsbruggen et al (2016) was based on previous research that identified the effects of messages that emphasize risks of health-compromising behaviours. Such research identified

defensive behaviours in response to such messages (Liberman & Chaiken, 1992). In this study Liberman & Chaiken (1992) identified that individuals that read a health message that was highly relevant to them (via their current health behaviours pre-measured) believed the claimed link between a particular health behaviour and disease in the health message. This particular finding demonstrated that participants for which the health message was of low relevance, believed the health message more than participants for which the message was of high relevance. Such findings were evident for both high and low threatening messages. The authors suggest that the mechanism by which this finding arose was due to defensive actions. Defensive processing by high-relevance participants was also evident in regards to processing of threatening elements of the messages, as opposed to nonthreatening aspects. Feeling empowered could confirm individuals' ability to carry out such behaviours (i.e. "yes I can do it"). This suggests that messages using language targeted to increase self-efficacy and self-esteem may be more effective when improved health or appearance are communicated in such messages as the end goals of the desired behaviour (FV intake). Therefore, increased self-efficacy and self-esteem (via targeted language) could be sufficient to increase motivation.

1.13 Mood

Mood is another element that is important in the reciprocal relationships between food consumption, self-esteem and self-efficacy. As previously discussed, increased FV intake can be advantageous for a number of physical health outcomes including obesity and cardiovascular disease. However, FV can also have beneficial effects on mood-related outcomes. Relationships between a healthy diet and lower odds of depression and distress (McMartin, Jacka & Colman, 2013) and increased positive affect (White, Horwath & Conner, 2013) have been observed. Furthermore, positive effects have also been found to be related to intakes of foods characteristic of the Mediterranean diet such as FV (Ford, Jaceldo-Siegl, Lee, Youngberg & Tonstad, 2013). Positive associations between positive mood and self-esteem have also been observed (Totan, 2014) and previous research also demonstrates a positive correlation between positive affect and self-efficacy (Zhang, 2016). Such relationships between food intake and mood, self-esteem and mood, and self-efficacy and mood confirm reciprocal relationships which are important to examine in healthy eating interventions.

1.14 Message construction

Constructing messages that target self-esteem and self-efficacy are essential to increase feelings of capability and empowerment. Increased feelings of capability and empowerment could act as facilitators to positive health behaviour. Such goals can be achieved via direct messages. Examples of direct messages are evident in text messages, which, in the health promotion (particularly weight-loss) literature, are cumulative in use due to technology development. In qualitative research by Deliens, Clarys, Bourdeaudhuij & Deforche (2014) university students expressed positive attitudes towards individual level interventions that utilized direct communication. Participants also approved of social media as a form of communication. In research regarding the use of text messages in a weight management group, participants liked positive, encouraging and direct messages and were optimistic about the idea (Woolford, Barr, Derry, Jepson, Clark, Strecher & Resnicow, 2011). In a feasibility study of a text messaging intervention on healthy behaviours and weight loss maintenance Gerber, Stolley, Thompson, Sharp & Fitzgibbon (2009) demonstrated positive effects of messages of encouragement and motivation on decisions that affected behaviour. In this study messages of encouragement utilized the possessive pronoun "your" e.g. "remember your goal!" and the second person pronoun "you" e.g. "the more pounds you lose the less you carry". Similar findings have also been observed in regards to a text messaging intervention on nutrition knowledge (Brown, O'Connor & Savaiano, 2014). Alongside increased nutrition knowledge, increased fruit consumption was also achieved. In relation to FV consumption, Norman, Kolodziejczyk, Adams, Patrick & Marshall (2013) demonstrated a mediating effect on an experimental condition (that included a text messaging intervention) on weight loss. The authors infer that weight-loss interventions that target FV consumption and personalized messages are effective.

More specifically, Carfora, Caso & Conner (2016) examined the effects of a messaging intervention on the FV intake of Italian adolescents. In line with previous research, significant FV increases were observed in individuals in a message intervention group (as opposed to a no message control group). In relation to message type, higher increases were observed for those who received affective messages as opposed to instrumental messages. Affective messages in this study emphasized positive affective outcomes of FV consumption (e.g. reduced prevalence of anxiety and depression) and instrumental messages focussed on the physical benefits (e.g. reduces chance of contracting cancer). Similar findings regarding positive effects of direct and individualized messages on health-promoting eating behaviours

have also been observed by Patrick et al (2009); Napolitano, Hayes, Bennett, Ives & Foster (2013); Siopis, Chey & Allman-Farinelli (2015); Müller, Alley, Schoeppe, & Vandelanotte (2016); Pedersen, Grønhøj & Thøgersen (2016).Similar research has also been carried out in relation to online messages (Nyquist, Rhee, Brunt & Garden-Robinson, 2011), web-based interventions (Duan, Wienert, Hu, Si & Liipke, 2017), computer tailored magazines (Campbell et al, 2002) and mailed messages (Latimer, Williams-Piehota, Katulak, Cox, Mowad, Higgins & Salovey, 2008). Moreover, personalization has been found to be related to a greater sense of engagement in online consumer environments (Bright & Daugherty, 2012). In research by Duncan et al (2014) a web and mobile phone-based intervention that provided education and recommended challenges and self-monitoring of physical activity and healthy eating was effective at increasing these behaviours. In relation to self-efficacy, Long & Stevens (2004) identified the efficacy of a technology intervention on self-efficacy for FV.

There are a number of important elements that must be present for a direct message to be effective. Past research has identified positive effects via use of personalization via the addition of recipients' names (Kreuter et al, 2005). However, such additions are unfeasible in poster interventions. Firstly, including the second person pronoun "you" makes messages more personal and direct, which could lead to enhanced attention and feelings of capability via increases of self-efficacy and self-esteem. Secondly, use of the modal verb "can" as the operative word influences self-efficacy and indicates the presence of possibility. Such motivating language could lead to enhanced confidence followed by increased intrinsic motivation. Using the phrase "you can" produces feelings of empowerment which could lead to increased self-esteem and self-efficacy. Swan, Bouwman, Aarts, Rosen, Hiddink & Koelen (2018) identified empowerment as an important factor that should be addressed in nutrition strategies. Furthermore, use of the phrase "you can" could lead to enhanced feelings of self-control. Self-control has been found to be perceived as a facilitator to healthy eating (LaCaille et al 2011). In a longitudinal experimental study, Luszczynska et al (2016) demonstrated the efficacy of separate planning and self-efficacy interventions on FV intake. More specifically, the self-efficacy intervention in this study addressed mastery experience and included self-persuasive statements (e.g. yes I can do it). The interventions used in this study focussed on replacing energy-dense foods with FV.

Furthermore, use of the phrase "you can" could deter reactance. Ungar et al (2015) identified that participants that took part in healthy eating interventions that instructed participants to eat "5 portions of fruit and vegetables a day" or to "eat one more portion of fruits and

vegetables than usual" exhibited higher levels of reactance than the control group (that were just instructed to monitor their food intake) both immediately and one week after the intervention. In comparison to findings observed by Ungar et al (2015), use of the phrase "you can" adopts a less authoritative tone. A less commanding tone via the phrase "you can" may increase participants' levels of self-efficacy and self-esteem (as discussed in section 12) and influence them to increase their FV intakes.

1.15 Message-framing

The frame of a message is important to consider to ensure desired effects are achieved. Past research indicates that gain-framed messages are more effective for disease-prevention behaviours (O'Keefe & Jensen, 2006; Rothman, Bartels, Wlaschin & Salovey, 2006). This is evident in the healthy eating literature (Van 't Riet, Werrij, Nieuwkamp, de Vries & Ruiter, 2013; De Bruijn & Budding, 2016). Furthermore, Satia et al (2010), in a small sample study, identified that African-American adolescents preferred gain-framed, short-term messages regarding FV. Churchill & Pavey (2013) identified that gain-framed messages were effective in relation to the increase of FV intake for individuals with high levels of autonomy. Gain-framed messages have also been found to be more effective at increasing FV consumption, as opposed to loss-framed messages, when self-relevance was increased via a personalised message integrating the participants' first name (Dijkstra, Rothman & Pietersma, 2011). Such findings regarding message-framing suggest that direct, gain-framed messages would be beneficial.

1.16 Empowerment

The sense of identity that results from self-efficacy and self-esteem is important in regards to information response. In a message-framing study, Gerend, & Maner (2011) examined the effects of emotional state on message response. In this study participants who were induced to experience fear consumed more FV in a two-week period after viewing a loss-framed (as opposed to a gain-framed) message. Moreover, gain-framed messages were more effective for individuals that were induced to experience anger emotions. When the message was matched to the participant's emotional state increased FV consumption was observed. This suggests that when feelings of empowerment are induced via messages of encouragement and positivity, gain-framed messages would be more effective.

Recall of encouragement is evident early in life. For example, Hansen, Alfonso, Hackney & Luque (2015) identified high visual recognition of apples, bananas, strawberries, corn, carrots

and broccoli in children aged as young as 4 years. In the same study the children's recall of messages regarding encouragement of eating FV was also investigated. To obtain responses a structured set of open-ended questions was utilized. Enquiries were used to represent the meal environment at home. Such messages were operationalized according to Social Cognitive Theory. Positive outcome expectancy messages (e.g. get healthy; body can run fast) were reported most often, followed by command prompts (e.g. at least try a bite). Such findings support the inclusion of outcome expectancies in healthy eating communications (e.g. health-related consequences as discussed in section 10).

Furthermore, messages of positivity and encouragement can target self-esteem and self-efficacy. Positivity and encouragement are often successful in different food environments and during early life. For example, positive verbal encouragement from toddler caregivers has been found to be related to higher food acceptance (Dearden, Hilton, Bentley, Caulfield, Wilde, Ha & Marsh, 2009). Moreover, encouragement has been identified as a motivator for FV consumption amongst Nigerian children (Oluwakanyinsola Ojuolape, Olayinka &Tinuola, 2017) and to influence nurse's diets (Phiri, Draper, Lambert & Kolbe- Alexander, 2014). Parental encouragement in regards to weight status has also been identified in relation to food intake (Benedikt, Wertheim & Love, 1998; Vincent & McCabe, 2000; Anschutz, Engels & Van Strien, 2010). However, such research relates to verbal encouragement.

In regards to the aim of obesity-related communications, previous research has identified preferences for messages related to increased FV and messages that aimed to increase confidence (Puhl, Peterson & Luedicke, 2013). In this study participants also rated such messages as most motivating. From their findings the authors also discuss the potential efficacy of framing health messages so that confidence and self-efficacy to engage in such behaviours is enhanced.

1.17 The Elaboration Likelihood Model

According to the Elaboration Likelihood Model (Petty & Cacioppo, 1986), central processing involves active engagement with the persuasive message. Central processing can only occur when the individual possesses the motivation and ability to engage with the message. In healthy eating contexts this would be those who are considering dietary changes. On the other hand, persuasion via the peripheral route occurs when the motivation and ability to engage with the message are lacking. In the context of healthy eating this population would be those who have no desire to change their diet. In such instances individuals may agree with the

message due to reasons other than the strength of the message. Such factors may include the source of the message appearing to be trustworthy, or the message being attractive. This can be achieved via simple cues and specific target of emotions (Rusmevichientong, Streletskaya, Amatyakul & Kaiser, 2014). Therefore, this suggests use of the pronoun "you" followed by the modal verb "can" and a gain-framed outcome achieved by eating FV (e.g. you can look after your health by eating fruits and vegetables) would heighten engagement of central processing. The elaboration likelihood model (1986) therefore infers that increased immersion in persuasive communication (via use of language that increases empowerment via increased self-esteem and self-efficacy) would lead to increased persuasion (e.g. increased immersion in a healthy eating poster would lead to healthy eating behaviour). Furthermore, Peng (2008) demonstrated differential effects of experience mode on self-efficacy of adopting a healthy diet. In this study, mediated enactive experience resulted in higher self-efficacy in relation to healthy diet promotion.

1.18 Digital Interventions

With the increase of technology development, digital interventions would be advantageous to ensure young individuals are equipped with appropriate nutrition knowledge early, so they can continue healthy eating habits throughout life (and into the workplace). Low levels of information-seeking in regards to healthy eating have been observed. Colón-Ramos et al (2015) identified links between low FV consumption and a lower likelihood to seek health or medical information. Moreover, Papadaki & Scott (2005) also identified low levels of active pursuit of nutrition information, unless specific problems were present or when participant's children were young. Although research indicates that individuals do not seek information about healthy eating unless necessary, past research also demonstrates acceptance of health information if provided for them. Qualitative research by Hammerback et al (2015) identified positive perceptions of newsletters that incorporated health information. This also highlights ease of access as an important factor that contributes to knowledge increase. This supports the use of digital interventions which are advantageous due to quick and convenient access and ease of information storage.

Many digital modes of communication exist including emails, text messages and mobile applications (apps). Digital games are another form of informational delivery that can increase enjoyment via an engaging narrative and premise. The effects of sensory play and gamification approaches in relation to FV have been observed early in life, which supports

the use of interactive games (Coulthard, Williamson, Palfreyman & Lyttle, 2018; Coulthard & Sealy, 2017; Coulthard & Ahmed, 2016). The efficacy of digital interventions has been observed in past research (Rompotis, Grove & Byrne, 2014; Müller et al, 2016). Emails, in the context of health promotion, have also been found to be efficacious (Luszczynska, Tryburcy & Schwarzer, 2007). Early research has demonstrated sustained engagement with sequential health promotion emails at the workplace (Franklin, Rosenbaum, Carey & Roizen, 2006). Sustained engagement is essential to increase the efficacy of health promotion interventions and is more likely to exist due to easy email access on mobile phones. Due to increased mobile phone usage, sustained engagement, may therefore, result from this medium of communication. In the workplace, email has been identified as the preferred mode of communication for workplace health promotion programmes (Hammerback et al, 2015). The efficacy of a short-term email intervention has also been demonstrated in regard to positive food-related behaviours (Plotnikoff, McCargar, Wilson & Loucaides, 2005). Furthermore, Rompotis, Grove & Byrne (2014) demonstrated the efficacy of both email and text-based health promotion communications. The efficacy of text message interventions has been previously discussed in section 14.

Mobile apps have been found to be effective at increasing vegetable consumption in adults partaking in a weight loss trial (Mummah, Robinson, Mathur, Farzinkhou, Sutton & Gardner, 2017). Computer-delivered interventions have been found to improve health-related knowledge, attitudes and behavioural intentions (Portnoy, Scott-Sheldon, Johnson & Carey, 2008). In a meta-analytic study of 75 randomized controlled trials by Portnoy et al (2008) computer-delivered interventions were more successful at improving knowledge if they were aimed at diet and/or weight. The efficacy of an interactive internet-based program has also been found to be successful in relation to increased FV intake (Franko, et al, 2008).

1.19 Immersion

As previously discussed, the efficacy of text messaging interventions has been demonstrated in a range of studies. Engagement with such text messages would therefore require a particular degree of immersion to be successful. Positive effects of immersion have been observed in the healthy eating literature. Narrative immersion relates to mental absorption – how absorbed an individual is in the narrative (Walton, 1990). Increased levels of immersion could be achieved via novel game-based approaches that incorporate realistic aspects. Such factors would be easier to implement in game-based approaches. Games have been found to

influence a range of behaviours including energy efficient behaviours (Reeves, Cummings, Scarborough & Yeykelis, 2015) and likelihood to eat breakfast (Byrne, Gay, Pollack, Gonzales, Retelny, Lee & Wansink, 2012). This suggests that this would be an efficacious intervention to increase FV consumption. Grabowski (2013) utilized a unified theoretical approach incorporating identity, knowledge and participation to examine the effects of a computer game on adolescents' health knowledge. However, negative results were obtained due to a lack of perspective-taking enhanced by the game, which further supports the inclusion of relevant levels of immersion.

1.20 Nutrition knowledge provision

As previously discussed, FV knowledge has been found to be related to FV consumption (Wolf et al, 2008; Erinosho et al, 2012; Colón-Ramos et al, 2015; Appleton et al, 2018). Previous research has identified complex messages (which included factual details about FV) to be related to increased intentions to consume FV one month after exposure. Such messages also resulted in increased intake both at one-month and four-month follow-ups (Williams-Piehota, Pizarro, Silvera, Mowad & Salovey, 2006). However, Williams-Piehota et al (2006) reported no significant results regarding the effects of messages being congruent to need-for-cognition type. Therefore, this suggests that encouragement of healthy eating would be effective via communication of factual benefits of FV. Woolford et al (2011) conducted a qualitative pre-test study in which opinions of text messages used in a weight loss management program for adolescents were explored. Findings revealed a preference for direct messages with a positive, encouraging tone and enthusiasm for recipes and targeted tips. Nour, Rouf & Allman-Farinelli (2018) examined perceptions of a gamified self-monitoring app aimed at increasing vegetable intake in young adults. The app in question included goal-setting, visual representations of progress, mock social media posts and push notification messages. Gaming rewards were also incorporated into the app to sustain engagement. Findings showed that meal inspiration posts on the mock social media element of the app were viewed favourably as well as short and concise messages.

Overall, past research demonstrates acceptability and positive attitudes towards factual-based information regarding the benefits of FV. As previously discussed in section 8, if individuals are given a reason as to *why* they should engage in particular behaviours, they may be more likely to engage in such behaviour. In comparison to knowledge regarding FV *recommendations*, providing specific knowledge regarding the *benefits* of particular FV may

also be efficacious to increase consumption. Significant associations have been observed between nutrition knowledge and vegetable intake in children (Asakura, Todoriki & Sasaki, 2017). Nutritional messages, which highlight nutritional attributes of foods, have been found to be associated with immediate fruit selection in children (Bannon & Schwartz, 2006) and decreased sales of unhealthy foods in vending machines (Rosi, Zerbini, Pellegrini, Scazzina, Brighenti & Lugli, 2017). Furthermore, previous research demonstrates that individuals perceive FV to be healthy but are less knowledgeable about *what* they are beneficial for (Wolf et al, 2008).

Nutrition knowledge can be incorporated into games and may be engaged with more via this medium of communication. This is because games are more commonly used by younger audiences, therefore it could be inferred that higher levels of engagement, enjoyment and motivation would be evident in this age group. Increased nutrition knowledge has been identified after engagement in an educational board game for children (Amaro et al, 2006) and both knowledge and healthy eating practice in adolescents in Nigeria (Ogunsile & Ogundele, 2016). Digital games have also been found to be effective in teaching nutrition knowledge (Peng, 2009; Orji, Vassileva & Mandryk, 2013). Orji, Vassileva & Mandryk (2013) tested an interactive multi-player game called "LunchTime". This game required participants to choose a health goal from a list of five (manage weight, diabetes, blood pressure, build muscle and general well-being). During each round of the game players were presented with challenges which required them to choose the healthiest food option for their health goal from three meal choices. Challenges expired after 12 hours and points were awarded for correct choices. Having 12 hours to complete challenges prompted some participants to research nutrition information before completing the challenges. This finding demonstrates active pursuit of health information if necessary (as discussed in section 18). However, reflection of healthy food choices was also incorporated into real-life as a result of playing the game. Furthermore, the game also prompted the "self-evaluation" process of behaviour change advocated by the Transtheoretical Model (Prochaska, DiClemente & Norcross, 1992), and led to positive attitudes towards healthy eating. Furthermore, in support of section 9, participants in this study were interested in weight management. However, notable limitations of this study include a very small sample size and lack of significant results obtained.

1.21 Co-operative game approaches

Some research regarding the effects of games on behaviour change have adopted co-operative based approaches. Positive gamification results in an elementary school cafeteria have been observed by Jones, Madden, Wengreen, Aguilar & Desjardins (2014). This study utilized a co-operative school-wide approach where all pupils in the school were collectively one player. This was achieved by children voting for the next stage of the game. Although findings of this study cannot be generalized to older individuals, or different institutions (e.g. the workplace, universities), the foundations of it can. This is because the inclusion of choice was a positive way to increase engagement.

Bailey, Wise & Bolls (2009) demonstrated the importance of incorporating customization of game avatars in advergames. In this study, children who were able to customize a game avatar had a slower decrease of skin conductance levels over time. The authors infer that this indicator of sympathetic arousal will affect the strength of the emotional arousal experienced. In an extension of research by Jones et al (2014), Jones, Madden & Wengreen (2014) included virtual opponents as an additional element. In this approach children in participating schools were informed about whether fruits or vegetables were to be the target food (to be increased) for each day. Children were instructed to eat "a little more" than normal. Such an instruction supports research discussed in section 7. Findings demonstrated that increases in FV were present on days when fruits *or* vegetables were targeted. Due to this finding, the authors' conclusion, that the improvement resulted from the intervention, was supported. However, a disadvantage of co-operative game-based approaches is the lack of conclusive evidence regarding children's individual consumption.

1.22 Real-World Scenario

However, such games must include elements that target self-esteem and self-efficacy. Using a real-world scenario in such games (as opposed to a fantasy scenario) would increase relatability and could increase motivation. If an individual can relate to a scenario they may be more motivated to base their behaviour on the scenario in question. Thomson, Bhatt, Vazquez, Cullen, Baranowski, Baranowski & Liu (2015) demonstrated that a game (played by children) that incorporated action planning had significantly higher FV intake both in the short and long-term. Furthermore, Rompotis, Grove & Byrne (2014) demonstrated the effectiveness of habit-based informational interventions. In this study the aim of providing the intervention group with habit-based information (via email or text) was to increase the

automaticity of FV intake. One element of such messages was encouragement of eating the same types of FV at the same time each day. Such messages were found to be more effective than control messages that provided general tips regarding FV or healthy eating. Similarly, Nour, Rouf & Allman-Farinell (2018) demonstrated that the inclusion of situational cues that focussed on incorporating vegetables at different mealtimes was perceived positively in an app targeted towards vegetable increase. Healthy eating games which adopt a personal avatar have also been found to be effective at increasing self-efficacy for healthy eating over the long-term (Peng, 2009).

Effects of the use of games on FV consumption has been observed early in life. Advergames are developed with the intention to market particular products. In a study by Pempek & Calvert (2009) children who played a game that involved their character to consume healthy food were more likely to choose a healthy snack after game exposure compared to children who played a version of the game that involved their character eating unhealthy foods. However, as discussed by the researchers, the effects of such games were measured immediately via snack choice and not longitudinally. Furthermore, a content analysis of food advergames by Lee, Yoonhyeung, Quilliam & Cole (2009) revealed that 2.7% of such advergames aimed at children included an educational component about nutrition and/or health. Foods high in sugar (59.9 %) and candy and gum (28.6%) were most prevalent. Using a game that uses a character that players can relate to could enhance motivation and self-esteem.

1.23 Knowledge Recall

In research examining the impact of a website promoting the Mediterranean diet (Papadaki & Scott, 2005), qualitative data demonstrated positive attitudes towards self-test knowledge quizzes. In this study, participants also stated their desire for the inclusion of interactive features in further research. Positive perceptions for a quiz to monitor knowledge of vegetable serving sizes has also been identified in research regarding the efficacy of a mobile app (Nour, Rouf & Allman-Farinelli, 2018).

1.24 The present research

The overarching aim of the current research was to examine the effectiveness of a range of interventions at the workplace (or that could potentially be tested at the workplace). Firstly, previous posters that have previously been tested in the lab will be tested at the workplace, to verify the effectiveness in a real-world location. To examine the effects of language targeted

towards self-efficacy, the posters used in study 1 will be modified to enable such language to be incorporated in novel posters to be tested in study 2. Finally, a simple game-based approach, that could potentially increase self-efficacy via visualization of a real-world scenario, will be tested in study 3 to potentially reach a younger workplace audience.

Therefore, the present research will comprise 3 studies that examine the effects of either promotional or interactive modes of communication on FV consumption. Study 1 will investigate the effects of 8 health promotion posters in workplace canteens. This study will specifically examine the effects of the time-based outcome promoted ("current" vs "future" health/appearance), the content-based outcome promoted ("health" vs "appearance") and the number of portions promoted ("1 extra" Vs "5 portions") to examine any significant differences. FV sales data will be collected during a four-week period; one-week pre-intervention, one week during the intervention and two weeks post-intervention. Previous studies examining the efficacy of health-promotion posters have adopted a three-week measurement period (Iversen et al, 2007). However, the present study will adopt a four-week measurement time-frame to identify whether poster effects (if any) are maintained longer than immediately after poster presentation. Past research using health promotion materials has identified maintained positive behavior 15 days after message removal (Brownell, Stunkard & Albaum, 1980). The present study will examine the following hypotheses; 1. FV sales will be increased during poster viewing and will be maintained for two weeks after; 2. Promotion of increased FV intake to improve "current" as opposed to "future" health or appearance-related outcomes will result in increased FV sales; 3. Promotion of appearance-related factors will result in increased FV sales in comparison to health-based factors; 4. Use of the phrase "1 extra" will result in increased FV sales compared to use of the phrase "5 portions".

Study 2 will examine the effects of 6 novel health promotion posters that utilize targeted language aimed at increasing motivation via increased self-efficacy. Participants will be presented with one of six poster messages randomly. For each poster message, there will be a poster with images of fruits only, vegetables only and fruits and vegetables. Participants will be required to comment on their favourite poster. University students will form the population for this study. This is because such individuals experience a range of stressors such as sleep disruption and insufficient funds (El Ansari & Stock, 2010), that are precursors to increased stressors experienced at the workplace and can impact self-esteem and self-efficacy. Therefore, examining whether university students are sensitive to motivational

language in regards to health behaviours is important. Mood diaries will be completed alongside food diaries to identify particular mood states associated with self-efficacy. Participants will also provide data regarding self-efficacy and intentions in relation to FV, normal FV consumption, social norms, attitudes towards FV, health importance, weight importance, liking for FV, normal cake bar consumption, self-efficacy and attitudes in relation to cake bars and liking for cake bars. Measurements in relation to cake bars will form control measurements. As previously discussed, FV intake is related to obesity. Studies 1 and 2 will not use the word "obesity" but the phrase "body weight" instead. Although this practical decision is not based on findings by Puhl, Petersen & Luedicke (2013), their findings identified that messages that were rated as most positive and motivating did not use the word "obesity". The following hypotheses will be tested; 1. Participants that view experimental posters will have higher FV self-efficacy, mean general positive affect and FV intake scores *after* poster viewing compared to participants that view a control poster message; 2. Significant positive correlations will be observed between FV self-efficacy, mean general positive affect, FV intentions and FV intake *after* poster viewing; 3. Mean general positive affect and experimental poster condition will significantly predict FV self-efficacy; 4. FV self-efficacy and mean general positive affect will significantly predict FV intentions; 5. FV self-efficacy and mean general positive affect will significantly predict mean FV intake *after* viewing a health promotion poster with targeted language aimed at increasing self-efficacy; 6. Posters that include the phrase "you can" will result in increased FV self-efficacy and FV intentions.

Study 3 will examine the effectiveness of a novel health promotion game (constructed via Qualtrics) on FV consumption. The main sample of this pilot study will be university students. Data regarding health importance, weight importance, self-efficacy in relation to FV, social norms, liking for FV, normal consumption of FV and intentions will be examined as potential moderators of behaviour change as a result of game engagement. Measurements of normal water consumption, intentions to drink water, self-efficacy in relation to water consumption, weight importance in relation to water consumption, attitudes towards water intake, water intake one week *after* game completion and liking for water will comprise control measurements. Study 3 will test the following hypotheses; 1. There will be a significant positive correlation between FV intake and knowledge one week *after* game playing; 2. There will be a significant increase in FV knowledge one week after game playing; 3. There will be a significant positive correlation between FV knowledge

immediately after and one week *after* game playing; 4. There will be a significant positive correlation between FV intake at baseline and one week *after* game playing.

2. Study 1

Method

2.1 Design

Study 1 employed a mixed groups design, utilizing both within- group and between-group elements. Poster designs (of which there were 8) were the independent variable and utilized an independent-groups design element. Data regarding FV sales, obtained four times over a four-week period were the dependent variable, utilizing a repeated-measures design element.

2.2 Participants

Participants of the present study were canteen users in 9 workplace canteens in Dorset. Canteens were recruited via volunteering sampling and data was collected in naturalistic settings as customers bought from each canteen. The canteens in the present study varied in size and clientele, including large education establishments, a large hospital and small language schools.

2.3 Health Promotion Posters

8 posters were randomly tested in the workplace canteens. Each poster had a white background and images of fruit with a health promotion message centrally aligned in green font (see appendix 1); *1) Eat 1 extra fruit or vegetable today and improve your future heart health, 2) Eat 1 extra fruit or vegetable today and improve your current heart health, 3) Eat 5 fruits and vegetables today and improve your future heart health, 4) Eat 5 fruits and vegetable today and improve your current heart health, 5) Eat 1 extra fruit or vegetable today and improve your future body weight, 6) Eat 1 extra fruit or vegetable and improve your current body weight, 7) Eat 5 fruits and vegetables today and improve your future body weight, 8) Eat 5 fruits and vegetables today and improve your current body weight*

2.4 Fruit and vegetable sales

The number of dishes that included FV was collected for each day and used to represent the number of FV sold in each canteen. Information regarding the number of FV portions in each dish was not obtained. Therefore, each dish that included FV was counted as one FV serving. Data regarding FV sales were collected via till spreadsheets or completion of food charts prepared by the researcher. Some till spreadsheets provided by canteens included data regarding all food and drink items sold and prices. On the other hand, food charts prepared by

the researcher required canteens to indicate sales of dishes from the menu that included FV. Method of data collection was dependent on the preference of each canteen.

2.5 Procedure

Before the study commenced ethical approval was obtained from Bournemouth University Institutional Review Board. Potential workplaces were contacted via letter, email and/or phone to discuss participation. Each data collection period lasted four weeks between January 2018 and May 2018. Baseline data was collected for one- week before the intervention began. During the intervention 1-6 A4 copies of a randomly selected health promotion poster (depending on the size of each canteen) were placed in each canteen or shown on a computer screen via PDF for one week. Typically, large education establishments and hospitals displayed more posters (4-6), whereas the smaller language schools and institutions displayed less (1-2). Common poster locations were close to the till, menu and on prominent positions on canteen walls. The number and location of posters displayed did not differ systematically by poster type. Posters were taken down at the end of the intervention week. Data was collected for a further two weeks post-intervention to identify any poster effects.

2.6 Data Analysis

Weekly sales data was inputted onto Excel and transformed into a daily measure to enable missed days (i.e. Bank holidays) to be incorporated into analysis. A daily measure was obtained by dividing the weekly total by the amount of days it represented. Such daily measures were then inputted onto SPSS for the whole four-week time-frame. One-tailed bivariate correlations were carried out to examine relationships of sales across the four-week data collection period. Normality checks were carried out to check normal distribution of data. A repeated-measures ANOVA was carried out to examine whether there was a significant difference in FV sales (separately and together) over the four-week period of data collection. Due to the small sample size, and therefore the lack of variance between poster conditions, poster messages were analysed according to specific features, as opposed to each poster separately. Separate repeated-measures one-way ANOVAs were carried out to examine the effects of promotion of the time-based outcomes of FV intake “future vs current”; the content-based outcome of increased FV (encouragement to improve “your heart health (health-based message) or “your body weight (appearance-based message)) and the number of portions promoted “1 extra vs five portions”.

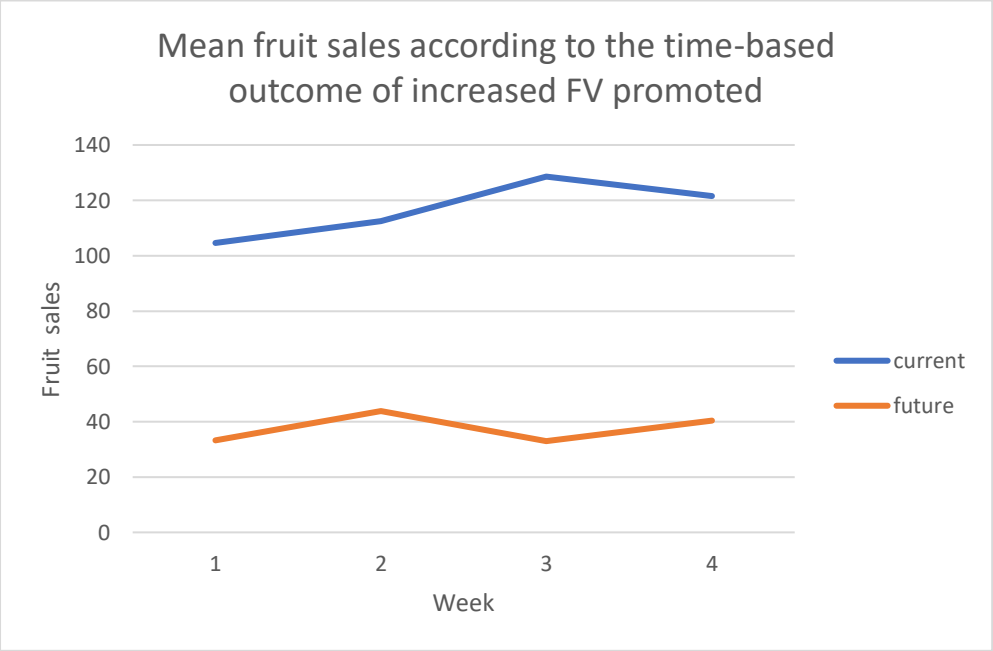
3 Results

A Kolmogorov-Smirnov test of normality showed that the dependent variable data (FV sales for each week) was not normally distributed (p=<.001). Therefore, results must be treated with caution.

3.1 The time-based outcome of FV consumption

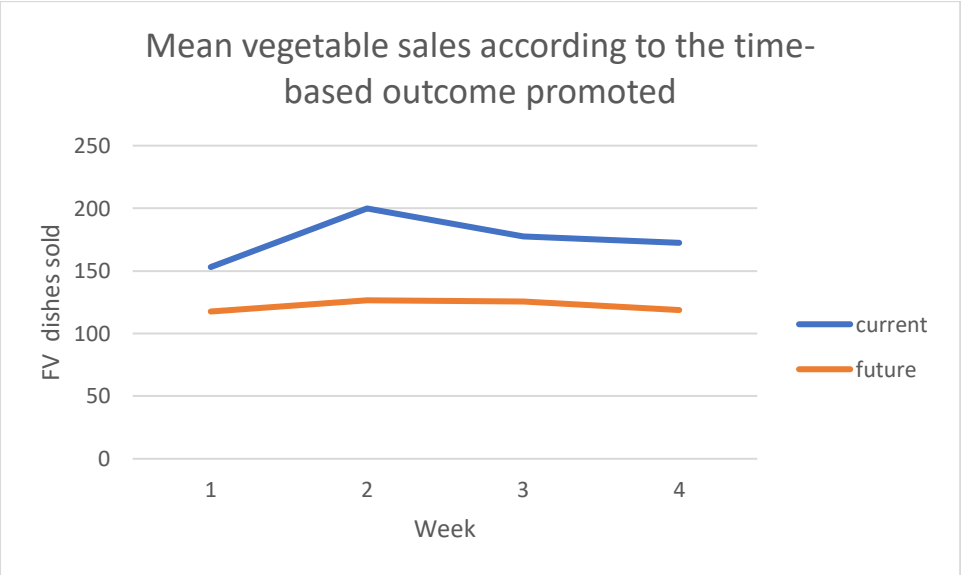
Mauchley's test indicated that the assumption of sphericity was violated, X^2 (5) = 108.82, p = <.001, therefore a Huynd – Feldt correction was applied. A one-way repeated measures ANOVA demonstrated that there was a significant main effect of time on fruit sales. Bonferroni post-hoc tests showed that sales during each week significantly differed, F (2.01, 167.03) = 9.856, p= <.001. Sales in week 4, 3 and 2 were significantly higher than week 1. There was a significant interaction between fruit sales and poster message promotion (either current or future outcomes), F (2.012, 167.030) = 11.410, p=<.001. Pairwise comparisons showed that, in institutions that displayed a poster that promoted consumption of FV to improve "current" health or appearance, fruit sales were significantly higher for week 4 than weeks 1 and 2. However, sales were significantly higher for week 3 than weeks 4, 2 and 1. For posters that promoted FV consumption to look after "future" health/ appearance, significantly higher sales were observed during week 4 than 1. Sales were significantly higher during week 2 than 1.

Figure 1: Fruit sales according to the time-based outcomes of FV consumption promoted



Mauchley's test indicated that the assumption of sphericity was violated, X^2 (5) = 386.20, *p* = <.001, therefore a Huynd – Feldt correction was applied. A one-way repeated measures ANOVA demonstrated a significant effect of time on vegetable sales, F (1.09, 90.89) = 10.64, *p* = .001. Vegetable sales were significantly higher during week 4 than week 1. However, sales during week 4 were significantly lower than weeks 2 and 3. A significant interaction was observed between vegetable sales and poster message element (current vs. future outcomes), F (1.095, 90.894), *p* = .029. Pairwise comparisons demonstrated that for canteens that displayed poster that promoted FV intake for improve current health/ appearance had significantly higher vegetable sales during week 4 than week 1. For places that displayed posters that encouraged FV intake to improve future outcomes, week 4 had significantly lower sales than week 2 then week 3.

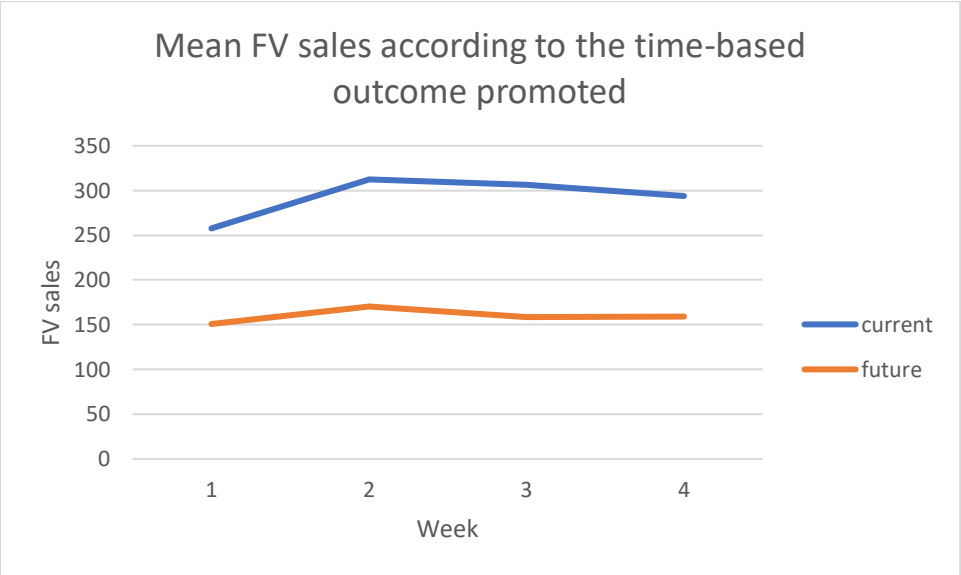
Figure 2: Vegetable sales according to the time-based outcomes of FV consumption



Mauchley's test indicated that the assumption of sphericity was violated, X^2 (5) = 418.91, *p* = <.001, therefore a Huynd – Feldt correction was applied. A one-way repeated measures ANOVA showed that there was a significant effect of time on FV sales, F (1.08, 89.64) = 12.562, *p*=<.001. Significantly higher FV sales were observed during week 4 than week 1. Week 2 sales were significantly higher than weeks 1, 2 and 4. A significant interaction was observed between FV sales over time and poster messages element (promotion of FV intake to improve current vs. future outcomes) F, (1.080, 89.646) = 4.11, *p* = .043. Pairwise

comparisons showed that week 1 sales were significantly lower than weeks 3 and 4 for canteens that displayed posters promoting FV consumption to improve current health/appearance outcomes. FV sales for institutions that displayed posters promoting FV consumption to improve future outcomes were significantly higher during week 2 than weeks 1, 3 and 4.

Figure 3: FV sales according to the time-based outcomes of FV consumption

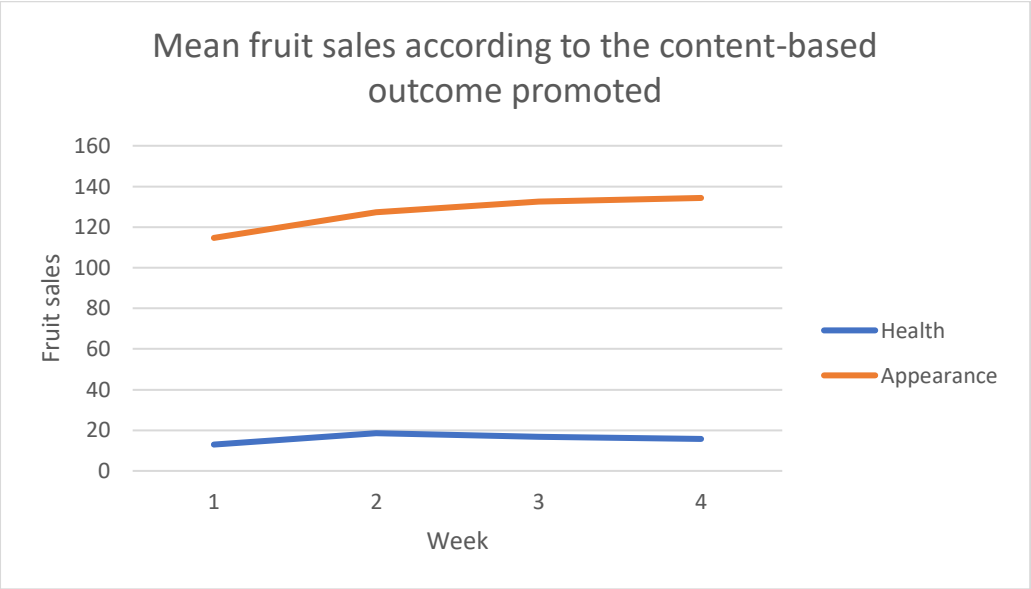


3.2 Effects of the content-based outcome of FV promotion

Mauchley's test indicated that the assumption of sphericity was violated, X^2 (5) = 132.10, *p* = <.001, therefore a Huynd – Feldt correction was applied. A one-way repeated measured ANOVA identified a significant effect of time on fruit sales during the 4 week period, F (1.96, 163.33) = 7.82, *p* = .001. Bonferroni post-hoc tests showed that fruit sales were significantly higher during week 4 and 3 than week 1. Sales during week 2 were significantly higher than week 1. A significant interaction was observed between fruit sales and poster message condition (posters that promoted FV consumption to improve health or appearance), F (1.968, 163.334) = 3.93, p = .022. Pairwise comparisons showed that canteens that displayed posters promoting FV to improve health-related outcomes had significantly higher fruit sales during week 4 than week 1. Sales were also significantly higher during week 3 than 4. For institutions that displayed posters that encouraged FV intake to improve

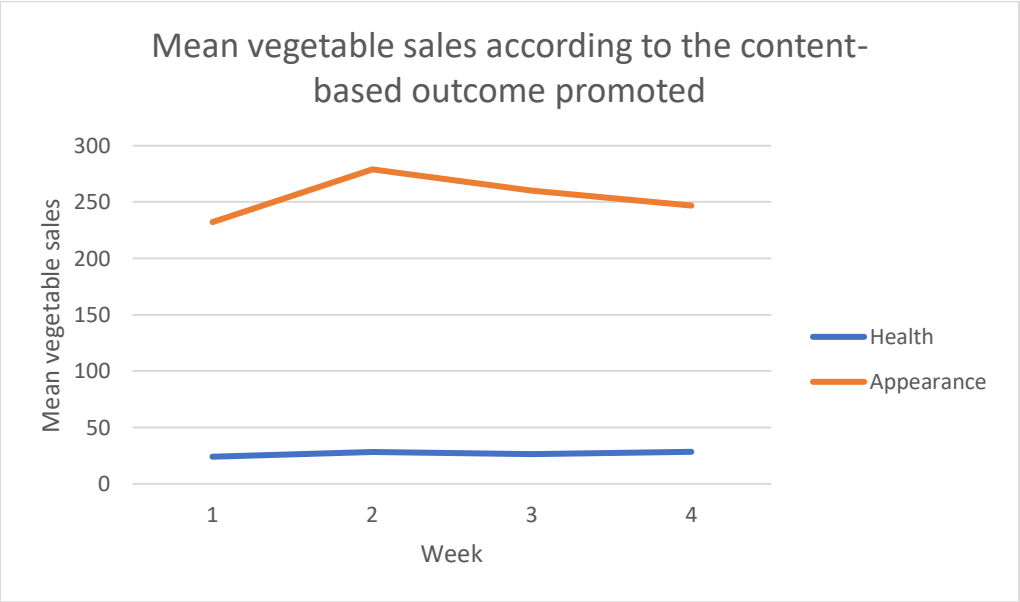
appearance-related outcomes, significantly higher fruit sales were observed during week 4 than 1 and 2.

Figure 4: Fruit sales according to the content-based outcomes of FV consumption



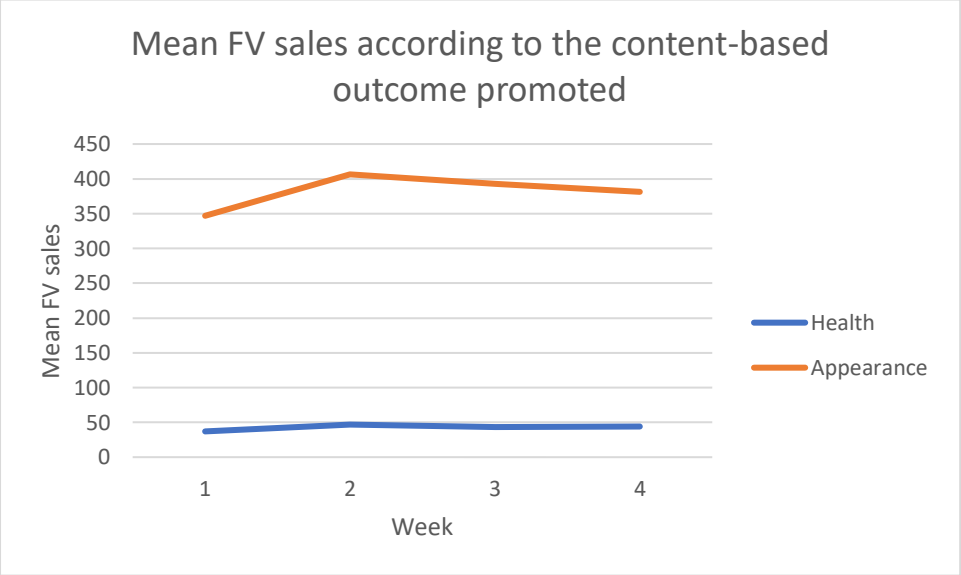
Mauchley's test indicated that the assumption of sphericity was violated, X^2 (5) = 378.81, *p* = <.001, therefore a Huynd – Feldt correction was applied. A one-way repeated measures ANOVA demonstrated a significant effect of time on vegetable sales, F (1.10, 91.32) = 9.160, *p* = .002. Week 4 had significantly higher sales than week 1, and significantly lower sales than weeks 2 and 3. A significant interaction was observed between vegetable sales and poster element (posters that promoted FV consumption to improve health vs appearance-based outcomes), F (1.100, 91.323) = 6.994, *p* = .008. Pairwise comparisons demonstrated that no significant differences in vegetables sales were present. For posters that promoted FV consumption to improve appearance, vegetable sales were significantly higher during weeks 4, 3 and 2 than week 1. During week 4 sales were significantly lower than weeks 2 and 3.

Figure 5: Vegetable sales according to the content-based outcomes of FV consumption



Mauchley's test indicated that the assumption of sphericity was violated, $X^2(5) = 376.36$, $p = <.001$, therefore a Huynd – Feldt correction was applied. A one-way repeated measures ANOVA demonstrated a significant effect of time on FV sales, $F(1.09, 91.23) = 11.06$, $p = .001$. Sales were significantly higher during week 4 than week 1. Sales during week 2 were significantly higher than weeks 1 and 3. A significant interaction was observed between FV sales and poster message condition, $F(1.099, 91.231) = 5.92$, $p = .014$. Pairwise comparisons showed that for canteens that displayed posters promoting FV consumption to improve health-related outcomes, week 1 sales were significantly lower than weeks 2 and 3. For canteens that displayed posters that encouraged FV consumption to improve appearance-related factors, week 2 sales were significantly higher than weeks 1 and 3.

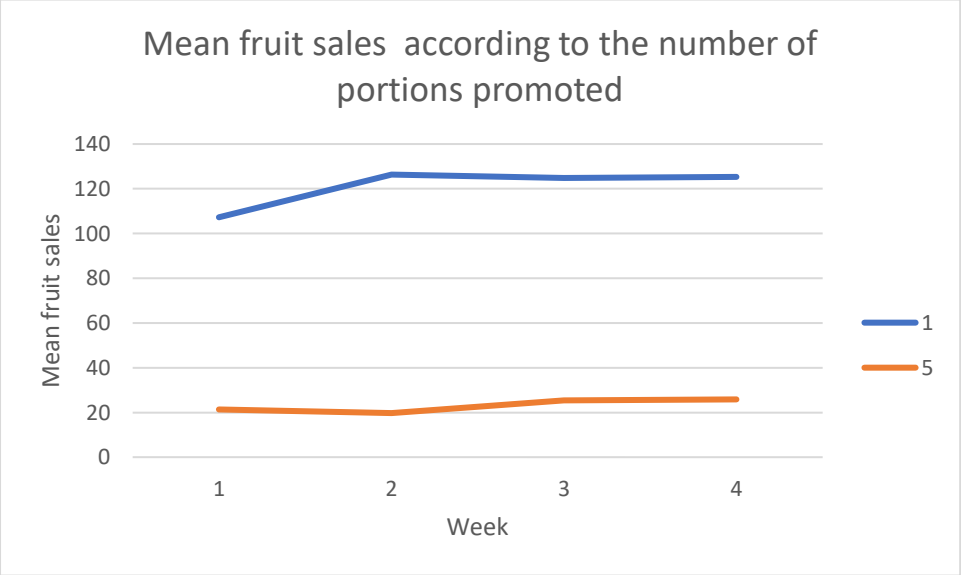
Figure 6: FV sales according to the content-based outcomes of FV consumption



3.3 Effects of the number of portions promoted

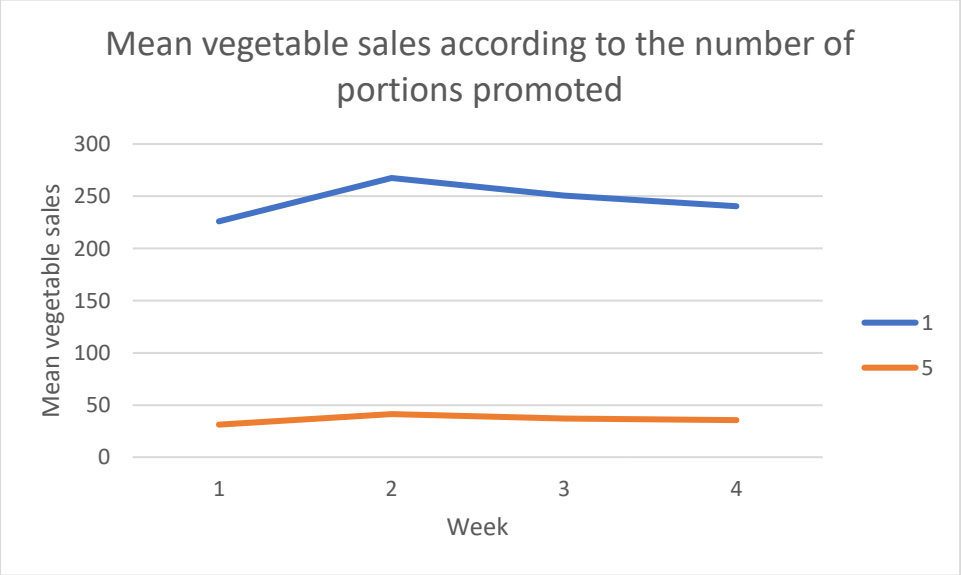
Mauchley's test indicated that the assumption of sphericity was violated, X^2 (5) = 121.67, *p* = <.001, therefore a Huynd – Feldt correction was applied. A one-way repeated measured ANOVA identified a significant effect of time on fruit sales, F (1.90, 158.30) = 7.928, *p*=.001. Bonferroni post-hoc tests showed that sales in weeks 4, 3 and 2 were significantly higher than week 1. A significant interaction was observed between fruit sales and poster message condition (either promotion of 1 extra or 5 portions of FV), F (1.907, 158.309) = 5.30, *p* = .007. Pairwise comparisons showed that fruit sales for canteens that displayed posters encouraging intake of "1 extra" portion of FV had significantly lower fruit sales during week 1 than weeks 2 and 4. Posters that encouraged consumption of "5 portions" had significantly higher sales during week 4 than weeks 2 and 1. Sales during week 3 were significantly higher than weeks 1 and 2.

Figure 7: Fruit sales according to the number of portions promoted



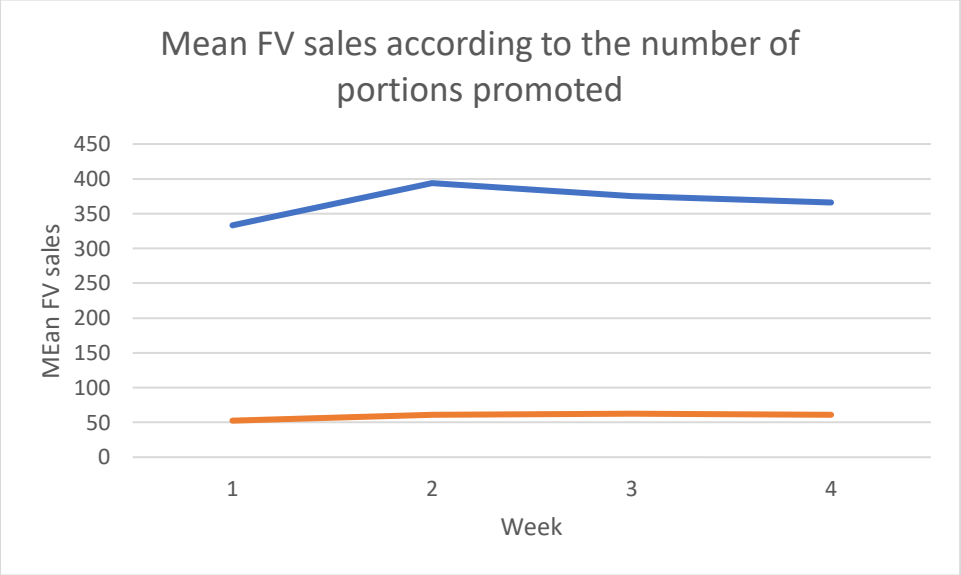
Mauchley's test indicated that the assumption of sphericity was violated, X^2 (5) = 377.83, *p* = <.001, therefore a Huynd – Feldt correction was applied. A one-way repeated measures ANOVA demonstrated a significant effect of time on vegetable sales, F (1.101, 91.40) = 9.04, *p*= .003. A Bonferroni post-hoc test showed that vegetable sales during week 4 were significantly higher than week 1 but were significantly lower than weeks 1 and 3. A significant interaction was not observed between sales over time and poster message condition (promotion of 1 extra portion of FV compared to 5), F (1.101, 91.407) = 3.430, *p*= .063.

Figure 8: Vegetable sales according to the number of portions promoted



Mauchley's test indicated that the assumption of sphericity was violated, X^2 (5) = 383.67, *p* = <.001, therefore a Huynd – Feldt correction was applied. A one-way repeated measures ANOVA showed that there was a significant effect of time on FV sales, F (1.09, 90.87) = 11.07, *p*= .001. FV sales were significantly during week 1 than weeks 2, 3 and 4. Week 2 sales were significantly higher than week 3. A significant interaction was also observed between FV sales and poster message condition (i.e. number of portions encouraged), F (1.095, 90.871) = 5.94, *p*=.014. Pairwise comparisons demonstrated that for posters that encouraged consumption of one extra portion of FV, sales were significantly higher during week 2 than week 1, 3 and 4. For posters that promoted consumption of 5 FV sales were significantly during week 1 than weeks 3 and 4.

Figure 9: FV sales according to the number of portions promoted



4 Discussion

Findings of study 1 support the use of a poster intervention to increase FV sales. Significantly higher sales were observed for three weeks after baseline data collection. In relation to specific poster messages, three particular elements were examined; communication of the time-based outcome of increased FV intake (current vs future outcomes), the content-based outcome of increased FV intake (improved health vs. appearance) and the number of portions promoted (1 extra v. 5).

4.1 Current vs future promotion of FV

Findings demonstrated that promotion of increased FV to improve "current" as opposed to "future" outcomes was significantly efficacious, particularly for fruit sales. This finding partially supports hypothesis 2 (Promotion of increased FV intake to improve "current" as opposed to "future" health or appearance-related outcomes will result in increased FV sales). However, such findings were only sustained for one-week post-intervention, which questions the message strength and length of exposure and only partially supports hypothesis 1 (FV sales will be increased during poster viewing and will be maintained for two weeks after). Furthermore, vegetable and combined FV sales increased during poster presentation, but decreased immediately after.

4.2 Health vs appearance.

Findings suggest that posters that promoted increased FV consumption to improve appearance-related factors may be more efficacious. Fruit sales were found to increase slightly during each week following baseline, which partially supports hypotheses 1 (FV sales will be increased during poster viewing and will be maintained for two weeks after) and 3 (Promotion of appearance-related factors will result in increased FV sales in comparison to health-based factors). On the other hand, vegetable, and combined FV sales increased during the intervention week but decreased immediately (and returned close to baseline levels). For canteens that displayed posters that promoted increased FV consumption to improve health-related outcomes, fruit, vegetable and combined FV sales remained relatively stable throughout the whole data collection period.

4.3 1 vs 5 portions

Findings suggest that promotion of "1 extra" portion of FV as opposed to 5 may be more efficacious. Fruit sales increased during the intervention week and remained stable for the remainder of the data collection period, which partially supports hypotheses 1(FV sales will be increased during poster viewing and will be maintained for two weeks after) and 4 (Use of the phrase "1 extra" will result in increased FV sales compared to use of the phrase "5 portions"). Vegetable and FV sales increased during the intervention week but decreased after poster presentation (which were close to baseline levels). In regards to posters that promoted consumption of 5 portions of FV, fruit, vegetable and combined FV sales barely differed from baseline.

4.4 Current health/ appearance outcomes

Efficacy of the word "current" in comparison to "future" supports previous research by Satia et al (2010), which demonstrated the salience of a short-term message for FV intake. This finding could be minimally related to delay discounting models of decision-making. A slight increase in vending machine sales of healthy snacks has been observed as a result of a brief time delay on the availability of usual vending machine snacks (Appelhans, French, Olinger, Bogucki, Janseen, Avery-Mamer & Powell, 2018). Such an effect could be generalized to study 1 if such findings were replicated in a repeated-measures examination. In such cases the time-delay tested by Appelhans et al (2018) would represent "future" rather than current outcomes (i.e. if customers can improve current health/ appearance, which is immediately attainable, this may influence their food choice). Furthermore, in conjunction with the

immediate food access available to customers, the word "current" may activate health goals sufficiently to deter snack food intake. Previous research by Boland, Connell & Vallen (2013) identified that health goal activation led to decreased snack food intake when self-regulatory resources were low (in the afternoon, typically when canteens are most busy). Participants may have perceived "current" health/ appearance as something they had more control over. Conversely, the lack of sustained changes observed may have also been related to the lack of perception of such changes (i.e. participants may not have seen an immediate effect of increased FV intake which may have deterred them from maintaining such changes).

4.5 Appearance-related outcomes

Findings suggest that individuals are driven to consume FV by appearance more than health, which supports previous research (Satia et al, 2010; Appleton, 2016). Such findings partially support research by Aubrey (2010), where increased appearance-related motivation to exercise was observed for women exposed to appearance-framed health articles compared to health-framed articles.

Research has identified a significant association between body weight perception and FV intake (Videon & Manning, 2003). Therefore, findings may be indicative of poor body weight perceptions/ status and/ or exposure to appearance-framed media content. The weight status of canteen users may have influenced results, and their responses to the outcome of increased FV. Ashton et al (2017), identified different FV motivators according to BMI. In this study obese individuals ranked "to lose weight" as the highest motivator to eat healthily. However, for obese individuals this could also be perceived as both an appearance and health-based motivator. The language used in the present study "improve your current/ future body weight" was neutral enough to apply to a range of weight statuses. Although individuals that may perceive themselves to be of a healthy weight may be more motivated by to "improve your future weight" as they may be satisfied with their current weight. Ashton el al (2017) also identified that individuals that were not currently meeting physical activity recommendations identified "to lose weight" as a key motivator. This could have implications for the present research. Although data was not obtained in regards to the current physical activity levels of canteen users, due to their status (worker) and/ or environmental aspects of their status (e.g. deadlines) they may have lacked the time to undertake recommended levels of physical activity. This may have led participants to perceive the poster messages related to appearance as a convenient way to improve appearance-related

factors while lacking the time to carry out recommended levels of physical activity. However, such an assumption would be dependent on participants' current levels of knowledge/ perceptions in regards to the specific benefits of FV (i.e. what they associate increased FV with). On the other hand, changing health behaviour to achieve appearance-related goals, may be perceived as more achievable, as appearance-related changes are more visible than health-based changes.

The rise of social media may have also influenced effects of appearance-based messages. Kinard (2016) identified that obese, as opposed to normal weight or overweight individuals, were more likely to interact with a healthy eating social media post. Although Kinard (2016) specifically investigated representation online (i.e. the presence of idealized virtual reality identity), such findings could be related to the present study. For obese individuals in the canteens studied, promotion of increased FV to improve "current" as opposed to "future" or "general" weight may have been sufficient enough to evoke behaviour change (particularly for individuals that are in the precontemplation stage of change). In the context of findings by Kinard (2016), canteen users in the present study may have been trying to communicate a particularly healthy lifestyle to their peers at the workplace. However, this suggestion would be more likely and easier to achieve online via an idealized virtual reality identity.

Although gender-based differences cannot be verified in study 1, past research suggests both males and females are motivated to eat healthily due to appearance-based factors. As evidenced by Herbert, Butler, Kennedy & Lobb (2010) appearance-based benefits of FV were recognised exclusively by women, whereas Caperchione, Vandelanotte, Kolt, Duncan, Ellison, George & Mummery (2012) identified consistent reports of healthy eating to maintain weight/ lose weight in males-based focus groups.

4.6 1 extra portion of FV

Participants may have perceived "1 extra portion" as a more achievable, manageable and convenient goal. Such findings could be compared to Duncan et al (2014) where participants chose to complete light strength challenges such as "eat 2 portions of fruit" most often. Low FV intake goals may be more achievable by consuming "1 extra portion" of FV (Sieverding & Scheiter, 2012). Promotion of "1 extra" portion may have led to a gradual increase in FV intake over time after the data collection period (i.e. if participants sustained intake of "1 extra" portion over a few months, this may have led to an increase in healthy-eating confidence and self-efficacy, and, potentially intake). Promoting increased consumption via

use of the word “extra” as an adjective may have been cognitively processed differently in comparison to the use of numbers as determiners in noun phrases (e.g. have one portion of fruit). Participants may have perceived the phrase “1 extra” as more informal, and therefore responded more favourably in comparison to the more formal tone of “1 portion”.

Such observations in the present study refutes findings by Ungar, Sieverding & Stadnitski (2013), where increased FV intake was observed for participants instructed to eat “5 portions” in comparison to “just one more”. To compare, however, the phrase “just one more”, and particularly the word “just” used by Ungar, Sieverding & Stadnitski (2013), may have been perceived as more patronising compared to “1 extra”. The present study demonstrated limited effects of posters encouraging “5 portions”. This may have occurred due to the setting of study 1. The present study took place in canteens, where it’s likely that a range of healthy eating communications circulate over time. In such instances, canteen users may have been accustomed to such posters (and not taken notice of a new poster promoting 5 portions of FV). In institutions that displayed posters encouraging “1 extra” portion of FV, the message (as opposed to the presence of a poster) may have been novel.

This finding may also be indicative of portion size perception. Past research has demonstrated little knowledge regarding portion sizes (Appleton et al, 2018). However, individuals may be able to guess how much one portion is equal to but, attempting to consume five portions may be perceived as a hard goal to achieve (especially if individuals have little knowledge regarding portion sizes). Past research has identified a discrepancy between self-assessed achievement of the recommended vegetable intake and actual intake (Teschl et al, 2018). Findings suggest that encouragement of “1 extra” portion was more successful in regards to fruit sales. Increased fruit sales may have arisen due to practical factors such as the spring seasons the majority of the study took place in. In hotter temperatures canteen users may have been inclined to eat an extra portion of summer fruits for example (which are likely to be promoted more during warmer temperatures). Likewise, the weather may have deterred customers from buying a hot vegetable-based dish.

4.7 Habits

Findings of the present study partially refutes past research that demonstrates habit strength as a predictor of intentions and fruit intake (Brug, de Vet, de Nooijer & Verplanken, 2006). For low FV consumers to break their habits, it is essential to address them via appropriate language. Results of the present study indicate that messages that promoted FV intake to

improve “current” health/ appearance, appearance-based factors or “1 extra” portion, may include appropriate language to induce habit change. This may be because many FV campaigns include habitual elements (i.e. promote FV to improve “health” as opposed to current or future health; health-based factors as opposed to appearance-based factors, and 5 portions as opposed to “1 extra”). Another habitual behaviour that has been found to be associated with increased FV intake, is breakfast consumption. Sugiyama, Okuda, Sasaki, Kunitsugu & Hobara (2012) identified that adolescents that ate breakfast daily had significantly higher FV intake than those that did not. Although this study involved adolescents, such effects may carry on throughout life and may influence responses to FV promotion. However, findings by Sugiyama et al (2012) were adopted in an Asian culture as opposed to the British culture the present study took place in. However, breakfast consumption cannot be completely overlooked as a potential confounding variable that may have influenced results in the present study. For example, some individuals may have eaten fruits during breakfast (or planned to eat them during dinner), and therefore decided to have a lunch that did not include FV.

4.8 Limitations

A limitation of study 1 refers to the method of data collection used. Data collection regarding the number of FV *dishes* sold as opposed to the number of *portions* sold did not allow accurate analysis or representation of dishes that included more than one portion of FV, which may have biased results. Secondly, although the real-world location of study 1 increased the external validity of findings, this setting did not enable measurement of potential confounding variables that may have influenced results for a workplace sample compared to a student sample (Appleton, 2016).

4.9 Future research

Future research could examine the same posters with varying language to represent “current” outcomes. Participants may respond better to more informal language.

5. Study 2

Method

5.1 Design

A within-groups design was employed for study 2. Poster designs (*n=6)* were the independent variable. Self-reported mood, self-reported FV intake and self-efficacy in relation to FV were measured as dependent variables both *before* and *after* poster viewing. Intentions to eat FV was measured as a dependent variable *after* poster viewing. Normal FV consumption was measured *before* poster viewing as a confounding variable alongside social norms, attitudes towards FV, health importance, weight importance and liking for FV which were measured one week prior to poster viewing (Time 1) and immediately after poster viewing (Time 2). Normal cake bar consumption was measured *before* poster viewing as a control variable alongside self-efficacy for cake bars and liking for cake bars which were measured *before* and *after* poster viewing. Attitudes towards cake bars was measured *after* poster viewing, also as a control variable. Participants were also asked distractor questions during both data collection sessions.

5.2 Participants

Ninety-seven individuals (12 males; aged 18-67 years, SD=6.15, 69.2% British) provided data on all variables. Participants were recruited via volunteering sampling using an online credit system for psychology students at Bournemouth University called SONA. The study was advertised as an investigation of "individual differences in eating habits and health promotion posters" to diminish the occurrence of demand characteristics. The only inclusion criteria was that participants were students at Bournemouth University.

5.3 Health promotion posters

Participants were randomized to view either an experimental health promotion poster (see appendix 2) that promoted consumption of;

- 1. Five fruits and vegetables: *"You can eat five portions of fruit and vegetables today"* (*n*=22) (poster 5T)
- 2. One more portion of fruits and vegetables: *"You can eat one more portion of fruit and vegetables today",* (*n=20*) (poster 1T)

- 3. Consumption of fruit and vegetables to look after health: *"You <u>can</u> look after your health by eating fruits and vegetables",* (*n*=19) (poster H)
- 4. Consumption of fruits and vegetables to look after body weight: *"You <u>can</u> look after your body weight by eating fruits and vegetables"* (*n*=19) (poster W)
- 5. Enjoyment of fruits and vegetables: *"You <u>can</u> enjoy fruits and vegetables"* (*n*=18) (poster E)

Or a control poster message directing participants to eat five fruits and vegetables daily:
6. "*Eat five fruits and vegetables per day (n*=18) (poster C)

Underlining of the word "can" in the experimental posters (5T, 1T, H, W, E) was present to emphasize the language targeted towards self-efficacy. To ensure posters were viewed appropriately, participants answered observation questions about their favourite poster. Such questions utilised open-ended and dichotomous responses; "what pictures are on the poster?" *(open-ended),* "Is the poster attractive to the eye?" *(yes – no),* "Do you think there should've been more information on the poster?" *(yes- no),* "what are your thoughts about the poster?" *(open-ended)* and "would you notice the poster in a canteen?" *(yes-no)*

<u>Assessment of dependent variables: self-reported mood, self-efficacy for FV and intentions to eat FV</u>

<u>5.4 Mood</u>

The positive and negative affect schedule – Expanded form (Watson & Clark, 1999) (PANAS-X) (see appendix 3) was used as a self-report measurement of mood. The PANAS-X provides a daily self-assessment of positive and negative affect. Participants were instructed to rate 60 varying emotions on a 5-point scale (1=very slightly or not at all, 5 = extremely) at the end of each day they completed food diaries. The PANAS-X consists of 13 subscales which comprise total summed responses to the items in each scale. In the present study the subscales "general positive affect" (PA) and "general negative affect" (NA) were measured as dependent variables for a three-day period both before and after poster viewing, to identify any changes in mood over time as an effect of language targeted towards self-efficacy in experimental posters or as a precursor to self-efficacy. Total "general negative affect" and total "general positive affect" scores were summed for each day. The mean of the total was then utilized to provide an overall score for each diary. Overall participants had a separate mean score for "general negative affect" and "general positive affect", each

separately, for *before* poster viewing (NA 1, PA 2) and *after* poster viewing (NA 1, PA 2). Higher scores for each scale indicated higher general negative affect or general positive affect.

5.5 FV intake

FV intake was measured via a self-report diary (see appendix 4) for three consecutive days before poster viewing (during one weekend day and two weekdays) and three consecutive days after poster viewing (during one weekend day and two weekdays) using a food diary adapted from research by Appleton (1999). In this diary participants were required to provide information regarding the content and location of their food and drink consumption for "*breakfast", "pre-lunch", "lunch", "pre-dinner", "dinner"* and *"after dinner".* The total portions of FV was summed for each day, according to international guidelines (5 portions/ 80g) and utilized as much information provided by participants (i.e. portions sizes and/or the weight of food consumed). The mean of the total for the three-day period was then utilized to provide an overall FV score for each diary. Participants had a separate mean total FV intake score for *before* (FV 1) and *after* (FV2) poster viewing.

5.6 Self-efficacy in relation to FV

Statements to measure self-efficacy were utilized or modified from previous research by Appleton (2016). Self-efficacy for FV was measured via 2 questionnaire items at time one; "To alter my fruit/ vegetable consumption would be easy" *(strongly disagree – neither agree or disagree – strongly agree).* Higher scores indicated higher self-efficacy. The alpha co-efficient was .586.

After poster viewing self-efficacy was measured via 10 questionnaire items; "I feel in complete control as to whether or not I will snack on fruit/ vegetables tomorrow" *(strongly disagree- strongly agree),* " How much control do you feel over whether or not you will snack on fruit/ vegetables tomorrow" *(no control at all – complete control), "*If I wanted to, I would have no problems succeeding to snack on fruit/ eat vegetables tomorrow" *(strongly disagree – neither agree or disagree – strongly agree),* "How confident are you that you could snack on fruit/ vegetables tomorrow" *(not at all confident – extremely confident), "* To alter my fruit/ vegetable consumption would be easy" *(strongly disagree – neither agree or disagree – strongly agree).* The maximum score was 70 and the minimum score was 10. Higher scores represented higher self-efficacy. The alpha co-efficient was .866

5.7 Intentions to eat FV

Intentions to eat FV was measured after poster viewing via 4 questionnaire items, modified from previous research by Appleton (2016); "I intend to snack on fruit/ vegetables tomorrow" (*not at all likely – extremely likely)* "how likely is it that you will snack on fruit/ eat vegetables tomorrow *(not at all likely – extremely likely).* The alpha co-efficient was .757. There was a maximum score of 28 and a minimum score of 4, with higher scores indicating higher intentions.

Assessment of confounding variables: normal FV consumption, social norms, attitudes towards FV, health importance, weight importance and liking for FV.

5.8 Normal FV consumption

All confounding variable measurements were utilized or modified from previous research by Appleton (2016). Normal FV consumption was measured via the statements; "When you snack between meals how often does your snack consist of fruits/vegetables" *(Never, rarely, sometimes, often, always)*. During analysis higher scores indicated higher consumption. 9 open-ended questionnaire items were also used to measure normal consumption *"Yesterday, how many portions/ how many fruits/ vegetables did you eat?", "On an average weekday how many portions/ how many fruits/ vegetables do you eat?", "On an average weekend day how many portions/ how many fruits/ vegetables do you eat?"* Such statements did not provide data regarding actual consumption. The alpha co-efficient was .767.

5.9 Social Norms

Social norms was measured at time 1 and 2 using 4 questionnaire items; *"*I would be affected if someone criticised my diet" *(strongly disagree – neither agree or disagree – strongly agree),* What other people think of my diet matters to me" *(strongly disagree – neither agree or disagree – strongly agree),* "I care that other people think that I am a person who takes care of his/her body weight" *(strongly disagree – neither agree or disagree – strongly agree),* "What others think of me in relation to my body weight is irrelevant" *(reverse scored; strongly agree – neither agree or disagree – strongly disagree).* The maximum score was 28 and the minimum score was 4. The alpha co-efficient was .797 at time 1 and .779 at time 2. Higher scores indicated higher influence of social norms.

5.10 Attitudes

Attitudes in relation to FV was measured after poster viewing via 10 statements; "My snacking on fruit/ vegetable consumption tomorrow would be" *(Unpleasant – pleasant, Unenjoyable – enjoyable, Harmful beneficial, Worthless- valuable),)," How* satisfied would you feel if you did snack on fruit/ eat vegetables tomorrow? *(not at all – a great deal),* There was a maximum score of 70 and a minimum score of 10. Higher scores represented more favourable attitudes. The alpha co-efficient was .802.

5.11 Health importance

Health importance was measured at both time points via 2 questionnaire items; "how important is your health to you?" (*not at all important – extremely important)* and "I am very aware of my health" (*not at all- very aware).* There was a maximum score of 14 and a minimum score of 2, with higher scores indicating higher importance placed on health. The alpha co-efficient was .637 at time 1 and .547 at time 2.

5.12 Weight importance

At time 1 weight importance was measured via 6 statements; "For you, how important is eating fruit/ vegetables in maintaining a healthy body weight" *(not at all important – extremely important)*, "For you how important is eating cake bars in maintaining a healthy body weight? (reverse scored) (*not at all important- extremely important),* "how important is your weight to you?" (*not at all important – extremely important)*, "I care that other people think that I am a person who takes care of his/her body weight" *(strongly disagree – neither agree or disagree – strongly agree),* "I think a lot about my body weight" *(strongly disagree – neither agree or disagree – strongly agree).* The maximum score was 42 and the minimum score was 6, with higher scores indicating higher importance placed on weight. The alpha co-efficient was .657.

During time 2 weight importance was measured via 11 questionnaire items; "how important is your weight to you?" (*not at all important – extremely important)*, "I care that other people think that I am a person who takes care of his/her body weight" *(strongly disagree – neither agree or disagree – strongly agree),* "I think a lot about my body weight" *(strongly disagree – neither agree or disagree – strongly agree),* "How personally important is it for you to snack on fruit/ vegetables tomorrow for your body weight" *(not at all important – extremely important)*, "How personally important is it for you to snack on cake bars tomorrow for your

body weight? (reverse scored) (*not at all important- extremely important),* "How much would snacking on fruit/ eating vegetables tomorrow make a difference to your body weight" *(not at all – a great deal),* "How much would snacking on cake bars tomorrow make a difference to your body weight? *(not at all- a great deal)* "How much would you regret not snacking on fruit/ vegetables tomorrow for body weight related reasons" *(not at all – a great deal)*, "How much would you regret not snacking on cake bars tomorrow for body weight related reasons" (reverse-scored) *(not at all – a great deal)*, "For you, how important is eating fruit/ vegetables in maintaining a healthy body weight" *(not at all important – extremely important)*. For you, how important is eating cake bars in maintaining a healthy body weight" (reverse-scored) *(not at all important – extremely important*) The maximum score was 105 and the minimum was 15. Higher scores indicated higher importance placed on weight. The alpha co-efficient was .757

5.13 Liking for FV

Liking for FV was measured via 2 questionnaire items during time 1 and 2; "I like fruit/ vegetables" *(strongly disagree – neither agree or disagree – strongly agree)*. The alpha co-efficient was .418 during time 1 and .284 at time 2. There was a maximum score of 14 and a minimum score of 2. Higher scores demonstrated higher levels of liking.

Control measurements

5.14 Normal cake bar consumption

All control variable measurements were utilized or modified from previous research by Appleton (2016). During time 1 measurements regarding normal cake bar consumption were obtained via 3 statements that required open-ended responses "Yesterday how many cake bars did you eat?", "On an average weekday how many cake bars do you eat?" and "On an average weekend day how many cake bars do you eat?" Such statements were modified from previous research by Appleton (2016). The alpha co-efficient was .807.

5.15 Self-efficacy in relation to cake bar intake

Self-efficacy in relation to cake bar intake was assessed via 1 statement at time 1; "To alter my cake bar consumption would be easy" *(strongly disagree – neither agree or disagree – strongly agree).* The maximum score was 7 and the minimum score was 1. Higher scores indicated higher self-efficacy.

At time 2, self-efficacy in relation to cake bar consumption was measured via 5 questionnaire items; "I feel in complete control as to whether or not I will snack on cake bars tomorrow" *(strongly disagree- strongly agree),* " How much control do you feel over whether or not you will snack on cake bars tomorrow" *(no control at all – complete control), "*If I wanted to, I would have no problems succeeding to snack on cake bars tomorrow" *(strongly disagree – neither agree or disagree – strongly agree),* "How confident are you that you could snack on cake bars tomorrow" *(not at all confident – extremely confident), "* To alter my cake bar consumption would be easy" *(strongly disagree – neither agree or disagree – strongly agree).* The maximum score was 35 and the minimum score was 5. Higher scores represented higher self-efficacy. The alpha co-efficient was .599.

5.16 Attitudes

Attitudes in relation to cake bar consumption was measured via 5 statements at time 2; "My snacking on cake bars tomorrow would be" *(Unpleasant – pleasant, Unenjoyable – enjoyable),* My snacking on cake bars tomorrow would be (Reverse-scored) *(Harmful-beneficial, Worthless- valuable),* "How satisfied would you feel if you did snack on cake bars tomorrow? (reverse-scored) *(not at all – a great deal).* The maximum score was 35 and the minimum score was 5. Higher scores signified more favourable attitudes. The alpha co-efficient was .266.

5.17 Liking for cake bars

Liking for cake bars was measured both before and after poster viewing via the statement "I like cake bars" (*strongly disagree-strongly agree)*. Higher scores represented higher levels of liking. The maximum score was 7 and the minimum score was 1.

5.18 Procedure

The present study was completed individually by participants in the psychology department at Bournemouth University during two 30-minute sessions between November 2017- May 2018. At the start of data collection participants were required to provide informed consent. In session one participants completed a Qualtrics questionnaire that incorporated measures of self-efficacy, normal FV consumption, social norms, attitudes towards FV, health importance, weight importance, liking for FV, normal cake bar consumption, self-efficacy for cake bars and liking for cake bars.

At the end of the first lab session, participants were required to complete a food diary (adapted from research by Appleton, 1999) for three consecutive days (2 weekdays and 1 weekend day) at home. On each day they completed the food diary participants were also required to complete the PANAS-X (Watson & Clark, 1999). After completion of the food diary participants were invited back to the labs (which was approximately one week after the first lab session). Participants were randomly presented with three out of eighteen posters (one message in three different designs) and were instructed to choose their favourite. Participants were then required to complete another Qualtrics survey, that included observation questions about their favourite poster and measures of self-efficacy for FV, FV intentions, social norms, FV attitudes, health importance, weight importance, liking for FV, self-efficacy for cake bars, liking for cake bars and attitudes towards cake bars. For questions regarding the poster participants were instructed to answer in relation to their favourite poster only. Again, participants were required to complete a food diary and mood questionnaires for three consecutive days (2 weekdays, 1 weekend day). After food diaries were returned to the researcher, participants were debriefed about the study.

5.19 Analysis

After data collection, food diary and mood questionnaire data was inputted onto SPSS and Qualtrics data was imported onto SPSS.

To examine whether participants in the experimental poster conditions had higher FV self-efficacy, mean general positive affect and FV intake scores (hypothesis 1), two independent one-way Analysis of Variance (ANOVA) tests were undertaken. In each one-way ANOVA poster message group was the independent variable with 6 levels. To ascertain poster effects, one independent one-way ANOVA examined whether scores measured *before* poster viewing significantly differed according to poster group and the other examined measurements obtained *after* poster viewing.

To examine whether there were any significant positive correlations between FV self-efficacy, mean general positive affect, FV intentions and FV intake *after* poster viewing (hypothesis 2) one-tailed bivariate correlations were undertaken with all variables measured *before* poster viewing. Separate one-tailed bivariate correlations were also examined between all variables measured *after* poster viewing, to identify any differences *before* and *after* poster viewing.

To examine effects of poster viewing and mood on self-efficacy (hypothesis 3), 4 multiple linear regressions were carried out using the Enter method. In the first (Model 1), self-efficacy for FV measured at time one was the outcome variable and mean general negative affect and mean general positive affect at time 1were predictor variables. An identical multiple linear regression (Model 2) was carried out with cake bar self-efficacy measured *before* poster viewing as the predictor variable to examine predictors of the control measurement of self-efficacy. To confirm changes in self-efficacy after poster viewing, 2 more multiple linear regressions were carried out. Self-efficacy for FV at time 2 was the predictor variable and mean general negative affect, mean general positive affect at time 2 and poster message condition were the outcome variables (Model 3). Again, an identical multiple linear regression (Model 4) was carried out with cake bar self-efficacy as the predictor variable and the same predictor variables as Model 3.

To examine whether FV self-efficacy and mean general positive affect significantly predicted FV intentions (hypothesis 4) a fifth multiple linear regression was undertaken (Model 5) using the Enter method. FV intentions was the outcome variable and self-efficacy for FV, mean general negative affect, mean general positive affect and liking for FV measured *after* poster viewing were predictor variables alongside poster message condition.

To examine whether FV self-efficacy significantly predicted FV consumption, (hypothesis 5) four multiple linear regressions were carried out using the Enter method. Two examined predictors of mean FV intake, and normal cake bar consumption *before* poster viewing. Two examined predictors of mean FV intake and cake bar intentions *after* poster viewing, to ascertain any poster effects. In the first (Model 6), FV intake *before* poster viewing (via the first food diary) was the outcome variable. Self-efficacy for FV was a predictor variable to identify whether this predicted FV consumption *before* poster viewing. Mean general negative and positive affect (measured before poster viewing, via the PANAS-X) were also predictor variables to identify whether such mood predicted FV intake alongside self-efficacy for FV. Normal FV consumption was a predictor variable to identify whether this predicted FV intake (via food diary completion), or whether such food diary data was influenced by taking part in a psychological study examining food intake (i.e. demand characteristics). The final predictor variable was liking for FV, as this was significantly positively associated with self-efficacy.

In the seventh multiple linear regression (Model 7), normal cake bar consumption at time 1 was the outcome variable. For the same reasons as the first multiple linear regression, mean general negative affect, mean general positive affect, self-efficacy and liking for cake bars measured *before* poster viewing were predictor variables.

In the eighth multiple linear regression (Model 8) mean total FV intake scores *after* poster viewing (via the second food diary) was the outcome variable. Self-efficacy for FV, mean general negative affect and mean general positive affect scores *after* poster viewing were the predictor variables alongside poster message condition, and intentions to eat FV. Again, liking for FV at time 2 was also an outcome variable as it was significantly positively correlated with FV self-efficacy *after* poster viewing. The ninth multiple linear regression (Model 9) examined control measurements, to examine predictors of cake bar consumption after poster viewing. Mean general negative affect, mean general positive affect, self-efficacy for cake bars, liking for cake bars and poster message condition measured *after* poster viewing were predictor variables. Cake bar intentions measured *after* poster viewing was the outcome variable.

A further 4 multiple linear regressions were carried out to examine whether viewing an intervention poster in comparison to viewing a control poster significantly predicted FV intake at time 2 (Model 10), cake bar intentions at time 2 (Model 11), FV intentions (Model 12) and FV self-efficacy at time 2 (Model 13). Such regressions were also carried out to examine hypothesis 6 (Posters that include the phrase "you can" will result in increased FV self-efficacy and FV intentions). Poster group condition (intervention vs control) (Poster I vs C) was a predictor variable in models 10,11,12 and 13. Experimental posters were coded as 1 and control posters were coded as 2. The remaining predictor variables for model 10 were self-efficacy for FV, mean general negative affect at time 2, mean general positive affect at time 2 and FV intentions.

The remaining predictor variables for model 11 were mean general negative affect at time 2, mean general positive affect at time 2, cake bar self-efficacy at time 2 and liking for cake bars at time 2.

The remaining predictor variables for model 12 were mean general negative affect at time 2, mean general positive affect at time 2, FV self-efficacy at time 2, week 2 FV intake and liking for FV at time 2.

Alongside poster message condition (I vs C), mean general negative affect at time 2 and mean general positive affect at time 2 were the predictor variables in model 13.

6. Results

Table 1 presents descriptive statistics for measurements of mean general negative affect (NA), mean general positive affect (PA), mean FV intake, normal cake bar consumption, and self-efficacy for FV and cake bars before (1) and after (2) poster viewing. A paired-sample t-test confirmed that there was not a significant increase in FV intake after poster viewing t (96) = -727, p=.469.

Table 1: *Descriptive statistics for mood, intake, self-efficacy, usual consumption and intention measurements*

	Mean	Median	Range	Standard Deviation
NA1[a]	15.08	14.00	30.00	4.72
NA 2[a]	14.29	13.00	24.67	4.93
PA 1[b]	23.06	23.66	30.67	6.66
PA 2[b]	22.85	23.33	25.33	6.60
FV 1[c]	2.19	2.00	8.50	1.61
FV 2 [c]	2.33	2.00	10.00	1.80
FV SE 1[d]	9.42	10.00	12.00	2.71
FV SE 2[d]	58.29	60.00	54.00	9.67
Cake SE 1[d]	4.64	5.00	6.00	1.79
Cake SE 2[d]	27.36	28.00	23.00	4.97
Usual FV [e]	19.83	19.00	36.00	7.61
Usual cake [e]	8.50	8.00	27.00	5.10
FV intentions [f]	21.21	22.00	22.00	4.82
Cake intentions [f]	3.12	3.00	6.00	1.69

[a] mean general negative affect before (1) and after (2) poster viewing [b] mean general positive affect before (1) and after (2) poster viewing [c] FV intake before (1) and after (2) poster viewing [d] self-efficacy for cake bars before (1) and after (2) poster viewing [e] usual FV and cake bar intake [f] intentions to consume FV and cake bars

6.1 Characteristics of participants by poster message condition

The most popular poster design for each poster message condition was examined by the mode. For every poster message except 5T, the poster with images of fruit only was the mode. The most popular design for 5T was with images of FV.

6.2 Measurements *before* poster viewing

A Kolmogorov-Smirnov test of normality showed that the independent variable, poster message group, was not normally distributed (p=<.001). Therefore, results must be treated with caution see appendix 5.

An independent one-way ANOVA indicated that FV self-efficacy, mean general positive affect and FV intake measured *before* poster viewing did not differ according to poster message group.

6.3 Measurements *after* poster viewing

An independent one-way ANOVA indicated that mean general positive affect scores, F (5, 91) = 2.671, p= .027, differed significantly according to poster message group. A post-hoc Tukey test demonstrated that participants in poster C had significantly higher mean general positive affect scores *after* poster viewing than participants in poster 1T.

Table 2: Mean general positive affect score measured after poster viewing according to poster message group

Poster message	*n*	Mean	Range	Standard Deviation
5T [a]	17	23.68	22.67	5.81
1T [b]	17	19.47	17.33	5.25
H [c]	18	20.51	24.00	6.64
W [d]	16	23.95	23,67	6.78
E [e]	15	23.88	25.00	7.24
C [f]	14	26.59	20.33	6.15

Poster messages: [a] "you can eat five portions of fruits and vegetables today" [b] "you can eat one more portion of fruits and vegetables today" [c] "you can look after your health by eating fruits and vegetables" [d] "you can look after your body weight by eating fruits and vegetables" [e] you can enjoy fruits and vegetables" [f] "Eat five fruits and vegetables per day"

6.4 Correlations between variables

One-tailed bivariate correlations were undertaken between all variables measured *before* and *after* poster viewing to ascertain any significant relationships.

For variables measured *before* poster viewing the largest significant negative correlation was observed between mean general negative affect and usual FV consumption: (r=-.237). The smallest significant negative correlation was observed between mean general positive affect and normal cake bar consumption (r= -.183). The largest significant positive correlation was observed between social norms and weight importance (r = .640). The smallest significant positive correlation was observed between FV attitudes and FV self-efficacy (r=.172).

To ascertain significant relationships between variables measured *after* poster viewing, one-tailed Pearson's correlations were undertaken. The only significant negative correlation observed was between liking for FV and mean general positive affect (r= -.208). The largest significant positive correlation was observed between weight importance and social norms (r=.644). The smallest significant positive correlation was observed between mean general positive affect and self-efficacy for FV (r=.203). Hypothesis 4 was partially supported. FV self-efficacy was significantly positively correlated with mean general positive affect (r=.203) and FV intentions (r=.418).

6.5 Predictors of self-efficacy

A Kolmogorov-Smirnov test of normality showed that each of the predictor variables tested were not normally distributed (self-efficacy for FV 1, p = <.001, self-efficacy for cake bars 1, p= .001, self-efficacy for FV 2, p = .001, self-efficacy for cake bars 2, p = .038. Therefore, results must be treated with caution (see appendix 5).

Table 3 (Model 1) confirms that none of the predictor variables were significantly able to predict variance in FV self-efficacy scores measured *before* poster viewing. The multiple linear regression was able to predict 0.12% of the sample outcome variance (Adj R^2 = -.009), which was found to not significantly predict outcome, F (2, 94) = .560, p =.573.

Table 3: Predictors of FV self-efficacy before poster viewing

	FV SE 1	
	β	Sig.
Model 1		
NA 1 [a]	-.044	.456
PA 1 [b]	.028	.509

[a] mean general negative affect before poster viewing [b] mean general positive affect before poster viewing

Table 4 (Model 2) confirms that mean general positive affect was significantly able to predict variance in self-efficacy for cake bar scores. The multiple linear regression model was significantly able to predict .088% of sample outcome variance (Adj R^2 = .069), which was found to significantly predict outcome, F (2, 94) = 4.540, *p* = .013.

Table 4: Predictors of cake bar self-efficacy before poster viewing

	Cake SE 1	
	β	Sig.
Model 2		
NA 1 [a]	-.053	.160
PA 1[b]	**.066**	**.014**

Emboldened values are significant (P=<.005) [a] mean general negative affect before poster viewing [b] mean general positive affect before poster viewing

Table 5 (Model 3) confirms that none of the predictor variables were significantly able to predict variance in self-efficacy for FV measured after poster viewing. The multiple linear regression model was able to predict 0.46% of sample outcome variance (Adj R^2 = .015) which was found to not significantly predict outcome, F (3, 93) = 1.485, *p* = .224.

Table 5: Predictors of FV bar self-efficacy <u>after</u> poster viewing

	FV SE 2	
	β	Sig.
Model 3		
NA 2 [a]	-.087	.661
PA 2 [b]	.288	.062
Poster [c]	.277	.640

[a] mean general negative affect after poster viewing [b] mean general positive affect after poster viewing [c] poster message condition

Table 6 (Model 4) confirms that none of the predictor variables were significantly able to predict variance in self-efficacy for cake bar scores. The multiple linear regression model was able to predict 0.10% of sample outcome variance (Adj R^2 = -.022), which was found to not significantly predict outcome, F (3, 93) = .312, p = .817.

Table 6: Predictors of cake bar self-efficacy <u>after</u> poster viewing

	Cake SE 2	
	β	Sig.
Model 4		
NA 2 [a]	-.054	.611
PA 2 [b]	.068	.403
Poster [c]	.025	.936

[a] mean general negative affect after poster viewing [b] mean general positive affect after poster viewing [c] poster message condition

<u>6.6 Predictors of intake</u>

A Kolmogorov-Smirnov test of normality showed that each of the predictor variables tested were not normally distributed (mean FV intake 1, p =.002, mean FV intake 2, p= <.001, normal cake bar consumption, p=<.001, cake bar intentions, p = <.001). Therefore, results must be treated with caution.

Table 7 (Model 5) shows that none of the predictor variables were significantly able to predict variance in mean FV intake at time 1. The multiple linear regression model was able

to predict 0.4% of sample outcome variance (Adj R^2= -.012), which was found to not significantly predict outcome, F (5, 91) = .768, *p*= .575.

Table 7: Predictors of FV intake before poster viewing

	FV intake 1	
	β	Sig.
Model 5		
FV SE 1[a]	-.012	.867
NA 1 [b]	-.035	.339
PA 1 [c]	.035	.203
Normal FV [d]	.009	.734
FV like [e]	.088	.329

[a] self-efficacy for FV measured before poster viewing [b] mean general negative affect before poster viewing [c] mean general positive affect before poster viewing [d] normal FV intake [e] liking for FV

Table 8 (Model 6) shows that, liking for cake bars was significantly able to predict variance in usual cake bar consumption scores (*p*= .001). The multiple linear regression model was significantly able to predict 1.49% variance in sample outcome variance (Adj R^2 = .112) which was found to significantly predict outcome, F (4, 92) = 4.020, *p* = .005.

Table 8: Predictors of cake bar intake before poster viewing

	Normal Cake	
	β	Sig.
Model 6		
Cake SE 1[a]	-.362	.224
NA 1 [b]	.113	.288
PA 1 [c]	-.136	.081
Cake like [d]	**1.119**	**.001**

Emboldened values are significant (P=<.005) [a] self-efficacy for cake bars before poster viewing [b] mean general negative affect before poster viewing [c] mean general positive affect before poster viewing [d] liking for cake bars

Table 9 (Model 7) shows that none of the predictor variables significantly predicted variance in mean total FV scores *after* poster viewing. The multiple linear regression model was able

to predict 0.8% variance in sample outcome variance (Adj R^2 =.024) which was found to not significantly predict outcome, F (6, 90) = 1.401 *p*=.223.

Table 9: Predictors of FV intake <u>after</u> poster viewing

	FV intake 2	
	β	Sig.
Model 7		
FV SE 2 [a]	.020	.196
NA 2 [b]	-.040	.196
PA 2 [c]	.053	.083
FV like 2 [d]	.100	.400
FV intentions [e]	-.009	.855
Poster [f]	-.168	.146

[a] self-efficacy for FV after poster viewing [b] mean general negative affect after poster viewing [c] mean general positive affect after poster viewing [d] liking for FV measured after poster viewing [e] intentions to eat FV [f] poster message condition

Table 10 (Model 8) confirms that liking for cake bars was significantly able to predict variance in cake bar intention scores measured after poster viewing. The multiple linear regression model was significantly able to predict 1.27% of sample outcome variance (Adj R^2 =.079) which was found to significantly predict outcome, F (5, 91) = 2.646, *p* = .028.

Table 10: Predictors of cake bar intentions <u>after</u> poster viewing

	Cake intentions	
	β	Sig.
Model 8		
Cake SE 2 [a]	.033	.332
NA 2 [b]	-.004	.906
PA 2 [c]	.027	.309
Cake like 2 [d]	**.331**	**.008**
Poster [e]	-.135	.185

Emboldened values are significant (P=<.005) [a] self-efficacy for cake bars after poster viewing [b] mean general negative affect after poster viewing [c] mean general positive affect after poster viewing [d] liking for cake bars measured after poster viewing [e] poster message condition

6.7 Predictors of FV intentions

Table 11 (Model 9) shows that FV self-efficacy and liking for FV were significantly able to predict variance in FV intention scores. The multiple linear regression model was significantly able to predict 3.61% of sample outcome variance (Adj $R^2 = 3.19$), which was found to significantly predict outcome, F (6, 90) = 8.490, $p = <.001$.

Table 11: Predictors of FV intentions after poster viewing

	FV intentions	
	β	Sig.
Model 9		
FV SE 2 [a]	**.159**	**.001**
NA 2 [b]	.028	.747
PA 2 [c]	-.039	.573
FV 2 [d]	-.043	.855
FV Like 2 [e]	**1.110**	**<.001**
Poster [f]	.190	.463

Emboldened values are significant (P=<.005) [a] self-efficacy for FV after poster viewing [b] mean general negative affect after poster viewing [c] mean general positive affect after poster viewing [d] FV intake after poster viewing [e] liking for FV measured after poster viewing [f] poster message condition

6.8 Effects of intervention vs control poster messages

Table 12 (Model 10) shows that none of the predictor variables were significantly able to predict variance in FV intake scores at time 2. The multiple linear regression model was able to predict 0.7% of sample outcome variance, (Adj $R^2 = .014$), which was found to not significantly predict outcome, F (6, 90) = 1.220, $p = .303$.

Table 12: Predictors of FV intake <u>after</u> poster viewing depending on poster condition

	FV intake 2	
	β	Sig.
Model 10		
FV SE 2 [a]	.018	.411
NA 2 [b]	-.049	.197
PA 2 [c]	.054	.083
FV like 2 [d]	.146	.206
FV intentions [e]	-.007	.880
Poster (I vs C) [f]	-.583	.289

[a] self-efficacy for FV after poster viewing [b] mean general negative affect measured after poster viewing [c] mean general positive affect measured after poster viewing [d] liking for FV measured after poster viewing [e] intentions to eat FV [f] poster message condition (intervention vs control)

Table 13 (Model 11) shows that liking for cake bars was significantly able to predict variance in cake bar intention scores at time 2. The multiple linear regression model was able to predict 1.1% of sample outcome variance (Adj R^2=.062), which was found to not significantly predict outcome, F (5, 91) = 2.278, *p*= .053.

Table 13: Predictors of cake bar intake depending on poster condition

	Cake intentions	
	β	Sig.
Model 11		
Cake SE 2 [a]	.034	.327
NA 2 [b]	-.002	.957
PA 2 [c]	.021	.429
Cake like 2 [d]	**.342**	**.006**
Poster (I vs C) [e]	-.191	.960

Emboldened values are significant (P=<.005) [a] self-efficacy for cake bars after poster viewing [b] mean general negative affect after poster viewing [c] mean general positive affect after poster viewing [d] liking for cake bard [e] poster message condition (intervention vs control)

Table 14 (Model 12) shows that liking for FV and FV self-efficacy were significantly able to predict variance in FV intention scores. The multiple linear regression model was able to predict 3.7% of sample outcome variance (Adj R^2=.327), which was found to significantly predict outcome, F (6, 90) = 8.792, *p*=<.001.

Table 14: Predictors of FV intentions depending on poster condition

	FV intentions	
	β	Sig.
Model 12		
FV SE 2 [a]	**.156**	**.001**
NA 2 [b]	.030	.724
PA 2 [c]	-.052	.455
FV 2 [d]	-.035	.880
FV Like 2 [e]	**1.036**	**<.001**
Poster (I vs C) [f]	1.572	.195

Emboldened values are significant (P=<.005) [a] self-efficacy for FV measured after poster viewing [b] mean general negative affect after poster viewing [c] mean general positive affect after poster viewing [d] FV intake after poster viewing [e] liking for FV measured after poster viewing [f] poster message condition (intervention vs control)

Table 15 (Model 13) shows that none of the predictor variables were significantly able to predict variance in FV self-efficacy scores *after* poster viewing. The multiple linear regression model was able to predict 0.6% of sample outcome variance, (Adj R^2=.037), which was found to not significantly predict outcome, F (3, 93) = 2.214, *p*= .092.

Table 15: Predictors of FV self-efficacy <u>after</u> poster viewing depending on poster condition

	FV SE 2	
	β	Sig.
Model 13		
NA 2 [a]	-.086	.662
PA 2 [b]	.250	.100
Poster (I vs C) [c]	4.238	.132

[a] mean general negative affect after poster viewing [b] mean general positive affect after poster viewing [c] poster message condition (intervention vs control)

7. Discussion

Findings of study 2 did not identify FV self-efficacy as a significant predictor of FV intake *after* poster viewing, which refutes hypothesis 5 (FV self-efficacy and mean general positive affect will significantly predict mean FV intake *after* viewing a health promotion poster with targeted language aimed at increasing self-efficacy). Moreover, hypothesis 3 (Mean general positive affect and experimental poster condition will significantly predict FV self-efficacy) must also be refuted as FV self-efficacy was not found to be predicted by mean general positive affect or poster message condition. Such findings may be indicative of weak strength of the language utilised in experimental poster messages targeted towards self-efficacy. On the other hand, the small sample size may have also contributed to results.

However, hypothesis 4 (FV self-efficacy and mean general positive affect will significantly predict FV intentions) was supported as FV self-efficacy was found to predict FV intentions (measured *after* poster viewing) alongside FV liking. Similar effects of liking for fruit on intentions have been observed by Appleton (2016). A number of factors may have contributed to the finding that FV self-efficacy was significantly able to predict intentions but not behaviour. Firstly, the reward value of FV intake, may have contributed to the intention-behaviour gap observed. As evidenced by Stirin Tzur, Ganzach & Pazy (2016), effects of self-efficacy were more positive when reward was high. This conditional view of self-efficacy may have been present in study 2. The reward value of FV intake (improved health/ appearance) may not have been communicated strongly enough for an effect of self-efficacy on performance (FV intake) to occur (Stirin Tzur, Ganzach & Pazy, 2016). The finding that FV self-efficacy predicted intentions but the poster message condition (intervention vs control) did not may also be dependent on the small sample size employed.

Lack of confidence to carry out such behaviour (potentially via meal preparation) or lack of time may have also influenced results. Meal preparation and lack of time have been identified as perceived barriers to healthy eating (Lappalainen, Saba, Holm, Mykkanen & Gibey, 1997; Larson, Perry, Story & Neumark- Sztainer, 2006; Ashton et al, 2017), also in student populations (Morse & Driskell, 2009; Greaney,et al, 2009; Herbert et al, 2010). Similarly, convenience has been identified as the strongest food motivation for students living in residence halls (Marquis, 2005). Although it is likely that a portion of the participants in study 2 were living in residence halls, this was not verified during data collection. Confidence in meal preparation may have also been a confounding variable that could have influenced

results. As in research by Utter, Larson, Laska, Winkler & Neumark- Sztainer (2018) perceived cooking skills have been identified as a predictor of nutrition-related outcomes a decade later. This may have been more prominent in the present population that are university students. Such a population have often left home for the first time and may have problems adjusting to living away from home (an aspect of which, could include meal preparation). On the other hand, the intention-behaviour gap evidenced may have been representative of lack of motivation to transfer intentions into behaviour. Such an assumption could be explained in the context of findings by Dutta-Bergman (2004), where higher attention and comprehension resulted from increased motivation. Previous research (Herbert et al, 2010) has identified that only males reported lack of motivation to consume FV. However, it would be hard to generalize such gender-based findings by Herbert et al (2010) to the heavily gender-biased participant cohort of mainly females in study 2.

In comparison to study 1, participants in study 2 were not in a canteen environment when they viewed the health promotion poster (and could, therefore, not act immediately in response to the poster message as in research by Appleton, (2016)). Although participants were given as long as they desired to observe the poster and were also required to answer questions related to the poster's message/ images (to enhance observation of posters), the amount of exposure cannot compare to real-life eating establishments where increased exposure is more authentic. In regards to the strength of the poster messages, longer information about the advantages and disadvantages of FV intake may have induced behaviour change more effectively via anticipated regret. Although the poster messages tested were similar to those tested by Appleton (2016) (where increased immediate fruit selection was observed after exposure to an appearance-based health promotion poster), the messages may have been too short to sufficiently address self-efficacy (i.e. more information may be necessary to "activate" self-efficacy and/or the mechanisms through which self-efficacy operates may be too complex to be addressed in a short poster message). Van Koningsbruggen et al (2016) directly addressed anticipated regret after a self-affirmation manipulation. Anticipated regret and FV intentions were found to be increased by self-affirmation. However, the health message read by participants in this study included FV benefits and strategies on how to increase consumption. Although the aim of a poster message is to be succinct, further research could replace the phrase "fruits and vegetables" with the name of a dish that includes 5 portions of fruit or vegetables (e.g. you can eat a 5 vegetable salad with chicken). Including such strategies in a short and concise poster message

with the phrase “you can” prior may better increase self-efficacy levels via the addition of a strategy to perform such behaviour. Participants may also be able to visualize themselves eating the dish in question, and this, in conjunction with the phrase “you can” could better address self-efficacy.

In partial support of hypothesis 2 (Significant positive correlations will be observed between FV self-efficacy, mean general positive affect, FV intentions and FV intake *after* poster viewing), FV self-efficacy was significantly positively correlated with mean general positive affect and FV intentions *after* poster viewing but not FV intake at time 2. Such significant correlations support past research (Zhang, 2016). However, the lack of a significant correlation between FV self-efficacy and FV intake, may also be indicative of the strength of the poster messages. The findings that none of the predictor variables were significantly able to predict variance in FV self-efficacy scores, highlights the multifaceted nature of FV self-efficacy, which may compare to self-efficacy for cake bars. In control analyses, liking for cake bars was a significant predictor of normal cake bar consumption and intentions related to cake bar consumption *after* poster viewing. The fact that FV liking score did not predict variance in FV self-efficacy scores, may be indicative of the motives behind such behaviour. It may show that cake bar consumption is driven by taste, whereas FV intake is not (and may therefore be perceived as a necessity rather than a pleasure). Therefore, self-efficacy to carry out a behaviour that is often perceived as non-enjoyable may be harder to address in comparison to self-efficacy for behaviours that are perceived as more enjoyable such as cake bar intake (which is often perceived as a treat). The cognitive process behind such FV intake may be more complex than that of cake bars (i.e. self-efficacy to look after oneself as opposed to self-efficacy to reward oneself) (Stirin Tzur, Ganzach & Pazy, 2016).

In regards to predictors of FV self-efficacy *after* poster viewing, mood and poster message condition, were not significant. Specific poster message condition (i.e. intervention vs control) also did not predict FV self-efficacy at time 2. However, mean general positive affect was a significant predictor of cake bar self-efficacy measured *before* poster viewing. This finding may be indicative of the close relationship between positive mood and cake bar intake. Such positive mood may be achieved by a particular event, and such cake bar consumption (predicted by mean general positive affect) may have been perceived as a reward. Therefore, participants may feel confident that they are able to reward themselves. However, associating cake bars as a reward may not be counterproductive. Kuijer & Boyce (2014) identified that individuals that associated chocolate cake with guilt (as opposed to

celebration) had lower confidence in regards to future healthy eating. As it could be inferred that participants in the present study may have perceived cake bar consumption as rewarding (due to mean general positive affect being a significant predictor of cake bar self-efficacy) this may suggest that participants were more confident they could eat healthily in the future (as FV self-efficacy was a significant predictor of FV intentions) but were unable to perform such behaviour, as they lacked the FV self-efficacy to do so.

7.1 Self-efficacy

The present study did not identify FV self-efficacy as a significant predictor of FV intake at either measurement point. Of note is the observation that participants in the control poster message condition (which did not include specific language targeted towards self-efficacy) had higher FV self-efficacy levels at both time points, although this finding was not significant. This may suggest that the levels of self-efficacy such participants had, may not have been sufficient enough to actively change behaviour (as opposed to actively intending to change behaviour) and that the language used in the experimental poster messages did not target these constructs sufficiently. Luszczynska, Tryburcy & Schwarzer (2007) targeted self-efficacy more explicitly, which led to increased FV consumption. In this study, the intervention equipped participants with knowledge regarding the benefits and uses of self-efficacy. An important element of the intervention included the use of verbal persuasion to enhance self-efficacy and supportive feedback to increase positive emotions. Such research was also more personalised as participants were provided feedback regarding their current levels of self-efficacy. Therefore, an understanding of self-efficacy may be at the core of increased effects. Moreover, Reyes et al (2015) identified that receiving social support in relation to diet moderates the effects of goal-setting. The phrase "you can" utilized on posters tested in study 2, could be perceived as a very slight form of verbal social support, which, again, may not have been explicit enough for participants to respond to. Finally, use of explicit personalization (Kreuter et al, 2005; Dijkstra, Rothman & Pietersma, 2011; Bright & Daugherty, 2012) may ultimately be the best way to increase self-efficacy. Use of the pronoun "you" may not have been perceived as personal enough.

The language used in the posters tested in the present study may not have been strong enough to produce empowerment and/or create self-affirmation. Addition of the word "yes" prior to "you can" may address self-efficacy more efficaciously and produce increased self-affirmation and feelings of empowerment. Again, previous research in this area (van

Koningsbruggen et al, 2016) addressed self-affirmation more overtly, In the present study, participants may have not understood the inclusion of the word "can". For example, they may have perceived it as patronising and/or an attempt at reverse psychology and may have displayed reactance. The vast majority of participants in the present study were aged 18-21 years. If different results were obtained with an older cohort, such an assumption regarding the perception of patronising and reverse psychological language may be age-related. However, this assumption also contradicts findings of previous research by Ungar et al (2015). In their study, increased levels of reactance were observed for participants that were instructed to eat a particular amount (5 or just 1 more) of FV per day.

Nagler (2014) demonstrated that exposure to contradictory nutrition messages (e.g. about wine, fish and coffee consumption) has been associated with doubt regarding nutrition information that is not associated with contradictory information (e.g. fruit and vegetables). In this study nutrition confusion was associated with contradictory message exposure and increased backlash. Furthermore, a negative correlation was present between nutrition confusion, backlash and intentions to engage in healthy behaviours. Therefore, as in research by Nagler (2014), the lack of significantly increased consumption levels observed in study 2 may have resulted from nutrition confusion resulting from conflicting media messages participants had been previously exposed to. It is likely that the vast majority of university students have access to varying media outlets (e.g. magazines, social media), the contradicting effects of which may have carried over to perceptions regarding FV intake. Similarly, Gough & Conner (2006), identified cynicism towards governmental health messages as a barrier to men's healthy eating.

Finally, the form of communication may have influenced results. The majority of participants in study 2 were aged 18-21 years, an age group that frequently uses social media. The use of social media in regards to recurrent marketing of unhealthy food has been noted in past research (Freeman et al, 2014). Therefore, participants may have been more receptive to such messages tested in the current study if posted on social media.

7.2 Limitations

A major limitation of study 2 was the use of self-report measures of mood and food intake, which can often produce demand characteristics. However, this element of measurement did not differ systematically. Participants may have been reluctant to complete such measures authentically. Furthermore, participants may not have been completely accurate regarding

portions sizes/ food weight during diary completion, which may have biased results. Another limitation is the lack of data collected regarding participants' perception of the self-efficacy targeted language utilised in the experimental poster messages. Finally, the small sample size for each of the 6 posters tested may have influenced the statistical tests utilized.

7.3 Future research

As participants in the present study were completing food diaries, further research could examine the effects of the poster messages incorporated into the food diaries in comparison to a poster. This approach may result in increased intake as participants would have a greater opportunity to change their behaviour. However, procrastination is a factor that may influence adherence to a food diary. Procrastination may have been a confounding variable in study 2. Research findings by Sirois (2004) indicates that less healthy behaviours are undertaken by procrastinators, due to decreased intentions. Moreover, during a high stress period, procrastination in students has been found to be related to delayed health treatment (Sirois, Melia-Gordon & Pychyl, 2003). If students in the current study were high procrastinators (also under high stress) this may have influenced their processing of the phrase "you can". This may have led participants to perceive the phrases used in the current study as something they had no obligation to adhere to. In such instances procrastination may have diminished the effects of self-efficacy on consumption.

8. Study 3

8.1 Design

A within-groups research design was used for study 3. Participants were required to complete part one and part two of the study at least one week apart. Game completion was measured as the independent variable and FV knowledge, consumption and intentions to eat FV were measured as dependent variables. Self-efficacy in relation to FV, health importance, general weight importance, weight importance in relation to FV, social norms, FV attitudes, and liking for FV were measured as confounding variables. Normal water consumption, intentions to drink water, weight importance in relation to water consumption, attitudes in relation to water intake, water intake one week *after* game completion and liking for water were measured as control variables.

8.2 Participants

Thirty-two individuals (4 males; aged 19-28 years, 84.5% British) participated in the current study. Participants were recruited via volunteering sampling using an online credit system for psychology students at Bournemouth University called SONA, or by following a social media link. There were no inclusion criteria for participants.

8.3 Health promotion game

The health promotion game in the current study adopted a simple survey format and was developed on Qualtrics (see appendix 6). The game, which utilized a 2nd person narrative, required participants to adopt a university student persona. At the start of the game participants were instructed to eat 5 FV via their persona and to retain as much information about them as they could, during the game. The narrative of the game took part in a normal day. Participants were presented with everyday scenarios (e.g. choosing what to eat for breakfast) and were required to choose from a range of options (e.g. eat porridge with fresh fruit, eat chocolate flavoured cereal or skip breakfast). When participants chose the healthy option (that included fruits or vegetables) (e.g. fresh porridge with fruits) they were required to demonstrate whether they knew a particular fact about a particular fruit or vegetable (e.g. did you know that apples contain vitamin C). When participants chose the unhealthy option during the scenario (e.g. choosing to eat chocolate flavoured cereal for breakfast) the healthy option was presented to them (e.g. why not try fresh porridge with fruits) and the relevant fact for the healthy option.

Measurement of dependent variables: FV knowledge, FV consumption and intentions to eat FV.

8.4 FV knowledge

Knowledge regarding benefits of particular FV (*apples, raisins, beetroot, tomato, cucumber, celery, leek, sweetcorn, pineapple, pear, courgette and mushroom*) was measured as the dependent variable. Such knowledge was measured three times; during the game (as a baseline measure), immediately after game completion and one week after game completion. During the game, 14 facts (2 of which were presented twice see appendix 6) were presented to participants via the phrase "*did you know that fruit/ vegetable X is good for/ contains Y etc…"* Participants were required to confirm their baseline knowledge using a dichotomous response *"yes-no"*. During analysis "*yes"* responses were coded as 1 and "*no"* responses was coded as 0. Therefore, higher scores indicated higher knowledge. Total baseline knowledge scores included scores for the first time facts were presented to participants (i.e. scores for the duplicate of facts were not included). For baseline knowledge there was a maximum score of 12 and a minimum score of 0. The alpha co-efficient was .807.

Knowledge was also measured immediately after the game via a short quiz. During this quiz participants were presented with the names of three fruits and/or vegetables in separate boxes and three facts. Participants were required to match each fact to one of the FV names. Correct responses were coded as 1 and incorrect responses were coded as 0. Therefore, higher scores represented higher knowledge. The maximum score was 12 and the minimum was 0. The alpha co-efficient was .633.

Approximately, one week after game completion, participants were provided with an exact replica of the quiz they completed at the end of the first lab session, to identify knowledge retention. Again, correct responses were coded as 1 and incorrect responses were coded as 0, therefore, higher scores represented higher knowledge. There was a maximum score of 12 and a minimum score of 0. The alpha co-efficient was .630.

8.5 FV consumption

FV consumption and intentions to eat FV were measured via statements used or modified from previous research by Appleton (2016). Normal consumption of FV was measured before the game via 9 open-ended questionnaire items *"Yesterday, how many portions/ how much fruits/ vegetables did you eat", "On an average weekday how many portions/ how*

much fruits/ vegetables do you eat?", "On an average weekend day how many portions/ how much fruits/ vegetables?"

Participants were also asked about their current intake of the FV mentioned in the game; "How often do you eat raisins/ beetroot/ tomatoes/ cucumber/ celery/ leeks/ sweetcorn/ apple/ pineapple/ pear/ courgette/ mushrooms (*never/ rarely/ occasionally/ regularly/ every day*). There was a maximum score of 60 and a minimum score of 12 for baseline consumption. Higher scores indicated higher consumption. The alpha-co-efficient for normal consumption of the FV mentioned in the game was .699.

Consumption of the FV from the game was also measured one week after game completion "how often in the past week have you eaten the following fruits and vegetables - raisins/ beetroot/ tomatoes/ cucumber/ celery/ leeks/ sweetcorn/ apple/ pineapple/ pear/ courgette/ mushrooms (reverse-scored) (*every day, 5 or 6 days, 3 or 4 days, 1 or 2 days, never).* This scale was used to ensure a specific representation of consumption over the previous week. There was a maximum score of 60 and a minimum score of 12, with higher scores being representative of higher consumption. The alpha co-efficient was .737. Such measurements were used to provide a general representation of intake rather than actual intake.

8.6 Intentions to eat FV

Intentions to eat FV was measured via 4 questionnaire items after game completion using a 7-point Likert scale; "Tomorrow, I intend to eat fruit/ vegetables that I don't always eat" (reverse-scored) (*Extremely likely- neither likely or unlikely, extremely unlikely)* and "tomorrow how likely is it that you will eat fruit/ vegetables that you don't always eat (*Extremely likely- neither likely or unlikely, extremely unlikely)* The maximum score was 28 and the minimum score was 4. Higher scores indicated higher intentions. The alpha co-efficient was .896.

Measurement of confounding variables: self-efficacy in relation to FV, health importance, general weight importance, weight importance in relation to FV, social norms, FV attitudes, and liking for FV

8.7 Self-efficacy in relation to FV

Confounding variables were measured via statements used or modified from previous research by Appleton (2016). Self-efficacy in relation to FV was measured via 2

questionnaire items before game completion; “To alter my fruit/ vegetable consumption would be easy” *(strongly disagree – neither agree or disagree – strongly agree)*

Self-efficacy was measured after game completion via 8 statements; “I feel in complete control of whether or not I will eat fruit/ vegetables that I don’t always eat tomorrow *(strongly disagree- strongly agree),* “ How much control do you feel over whether or not you will snack on fruit/ vegetables tomorrow” *(no control at all – complete control), “*If I wanted to, I would have no problems succeeding to eat fruit/ vegetables that I don’t always eat tomorrow” *(strongly disagree – neither agree or disagree – strongly agree),* “How confident are you that you could eat fruit/ vegetables that you don’t always eat tomorrow” *(not at all confident – extremely confident),”* The maximum score for self-efficacy was 70 and the minimum score was 10. Higher scores indicated higher self-efficacy. The alpha co-efficient was .712.

8.8 Health importance

Health importance was measured via 2 questionnaire items before game completion; “how important is your health to you?” (*not at all important – extremely important)* and “I am very aware of my health” (*not at all- very aware).* The maximum score was 14 and the minimum score was 2. Higher scores demonstrated higher importance placed on health. The alpha co-efficient was .664.

8.9 General weight importance

General weight importance was measured before game completion via 3 statements; how important is you weight to you? (*not at all important – extremely important),* I care that other people think that I am a person who takes care of his/her body weight *(strongly disagree – neither agree or disagree – strongly agree),* I think a lot about my body weight (*strongly disagree – strongly agree).* There was a maximum score of 21 and a minimum score of 3. Higher scores indicated higher importance placed on weight. The alpha co-efficient was .856

8.10 Weight importance in relation to FV

Before game completion weight importance in relation to FV was measured via the statements; “For you, how important is eating fruit/ vegetables in maintaining a healthy body weight? *(not at all important- neither agree or disagree – extremely important),*

After game completion weight importance in relation to FV was measured via the statements; "How personally important is it for you to eat fruit/ vegetables tomorrow that you don't usually eat for your body weight" *(not at all important – extremely important)*, "How much would eating fruit/ vegetables that you don't always eat tomorrow make a difference to your body weight" *(not at all – a great deal)*, "How much would you regret not eating fruit/ vegetables that you don't always eat tomorrow for body weight related reasons" *(not at all – a great deal)*. Overall there was a maximum score of 56 and a minimum score of 8. Higher scores represented increased importance of FV in relation to weight. The alpha co-efficient was .940.

8.11 Social norms

Social norms was measured before game completion via the statements *"*I would be affected if someone criticised my diet" *(strongly disagree – neither agree or disagree – strongly agree)*, What other people think of my diet matters to me" *(strongly disagree – neither agree or disagree – strongly agree)*, "I care that other people think that I am a person who takes care of his/her body weight" *(strongly disagree – neither agree or disagree – strongly agree)*, "What others think of me in relation to my body weight is irrelevant" *(strongly disagree- neither agree nor disagree- strongly agree*)The maximum score was 28 and the minimum score was 4. Higher scores suggested higher importance placed on social norms. The alpha co-efficient was .852.

8.12 FV attitudes

After game completion, FV attitudes was measured via 10 statements; "Eating fruit/ vegetables that I don't always eat tomorrow would be" *(Unpleasant – pleasant, Unenjoyable – enjoyable, Harmful beneficial, Worthless- valuable)*, "How satisfied would you feel if you did snack on fruits/ eat vegetables tomorrow? *(not at all -a great deal).* The maximum score for attitudes was 56 and the minimum score was 8.

8.13 Liking for FV

Liking for FV was measured before game completion via 2 questionnaire items; "I like fruit/ vegetables" *(strongly disagree – neither agree or disagree – strongly agree)*. The maximum score was 14 and the minimum score was 2. Higher scores demonstrated increased liking. The alpha co-efficient was .467.

Control Measurements: normal water consumption, intentions to drink water, weight importance in relation to water consumption, attitudes in relation to water intake, water intake one week *after* game completion and liking for water.

8.14 Normal water consumption

Normal water consumption was measured via 3 open-ended questions before game completion; "Yesterday, how much water did you drink?", "On an average weekday, how much water do you drink?", "On an average weekend day how much water do you drink?". Items were transformed into litres.

8.15 Intentions to drink water

Intentions to drink water was measured via 2 statements after game completion; "tomorrow, how likely is it that you will drink water? (reverse-scored) *(extremely likely- neither likely or unlikely – extremely unlikely),* I intend to drink eater tomorrow (reverse-scored) *(extremely likely- neither likely or unlikely – extremely unlikely)*. Higher scores represented lower intentions. The maximum score was 14 and the minimum score was 2. The alpha co-efficient was .964.

8.16 Self-efficacy in relation to water consumption

Self-efficacy in relation to water consumption was measured using 4 statements; "I feel in complete control of whether or not I will drink water tomorrow *(strongly disagree- strongly agree),* " How much control do you feel over whether or not you will drink water tomorrow" *(no control at all – complete control), "*If I wanted to, I would have no problems succeeding to drink water tomorrow" *(strongly disagree – neither agree or disagree – strongly agree),* "How confident are you that you could drink water tomorrow" *(not at all confident – extremely confident)*. The maximum score was 28 and the minimum score was 4. Higher scores indicated higher self-efficacy in relation to water intake.

8.17 Weight importance in relation to water consumption

Weight importance in relation to water consumption was measured before game completion via the statement; "for you how important is drinking water in maintaining a healthy body weight" *(not at all important- extremely important)*. After game completion weight importance in relation to water intake was measured via 2statements; "How personally important is it for you to drink water tomorrow for your body weight? *(not at all important-*

extremely important), "how much would you regret not drinking water tomorrow for body weight related reasons? *(not at all- a great deal)*. The maximum score was 21 and the minimum score was 3. Higher scores indicated higher importance of water in relation to weight. The alpha co-efficient was .802.

8.18 Attitudes towards water intake

Attitudes in relation to water consumption were measured via 5 statements; "Drinking water tomorrow would be" *(Unpleasant – pleasant, Unenjoyable – enjoyable, Harmful beneficial, Worthless- valuable)*, "How satisfied would you feel if you did snack on fruits/ eat vegetables tomorrow? *(not at all -a great deal)*. The maximum score was 35 and the minimum score was 5. Higher scores represented more favourable attitudes.

8.19 Water intake one week *after* game completion

Water intake one week after game completion was measured via the statement "has your water consumption changed in the past week?" *(0=no, 1= it has decreased, 2= it has increased)*. Higher scores were indicative of higher consumption.

8.20 Liking for water

Liking for water was measured before game completion with the statement "I like water" *(strongly disagree- strongly agree)*. The maximum score was 7 and the minimum score was 1.

8.21 Procedure

Participants were provided with the first Qualtrics link upon sign up to the study. An information sheet and consent form were incorporated into the survey, to obtain informed consent before the study began. Before the game element of the Qualtrics survey, participants were required to provide demographic data (age, gender, nationality), followed by information regarding normal fruit, vegetable and water consumption, self-efficacy, liking for fruits, vegetables and water, health importance and social norms related to fruit, vegetable and water consumption.

Part one of this study (the game element and questions before and after game playing) took approximately thirty minutes to complete. At the end of the session participants were required to provide their email address so they could be emailed the link to the second survey a week later. The second survey took approximately twenty minutes to complete. Participants were

presented with the same quiz from the end of the game during the first week, to identify the strength of knowledge retention.

8.22 Analysis

After data collection, data was imported from Qualtrics to SPSS.

One-tailed bivariate correlations were examined between all measurements both *before* and *after* game playing to examine any game effects, and more specifically, hypotheses 2 and 3. A paired samples t-test was carried out to examine differences in FV knowledge *before* and *after* game playing.

9 Results

Table 16 presents descriptive statistics for measurements of FV intake at baseline, (General FV intake) and one week after game playing (FV intake 2) and FV knowledge at baseline (FV knowledge 1) and one week after game playing (FV knowledge 2).

Table 16: Descriptive statistics for FV intake and knowledge measurements

	Mean	Median	Range	Standard Deviation
General FV intake	30.06	30.50	27.00	5.97
FV intake 2 [a]	52.34	53.00	23.00	5.29
FV knowledge 1 [b]	3.37	2.00	11.00	2.79
FV knowledge 2 [c]	7.12	7.00	9.00	2.43

[a] FV intake one week after game playing [b] FV knowledge at baseline [c] FV knowledge one week after game playing

9.1 Correlations

To examine hypotheses 1 and 3 one-tailed bivariate correlations were carried out between all variables measured both *before* and *after* game playing. A significant positive correlation was observed between knowledge scores immediately after game playing and one week *after* game playing (r=.315). A significant positive correlation was observed between FV intake (of FV from the game) at baseline and one week *after* game playing (r=.764). A significant correlation was not observed between FV knowledge and intake one week *after* game playing.

Correlations were also examined between all variables measure to identify any significant correlations between the dependent and confounding variables measured. In regards to the confounding variables measured, the largest significant positive correlation was observed between intentions to drink water and water self-efficacy (r=.858). The smallest significant positive correlation was observed between water consumption measured one week after game playing and baseline FV consumption (r=.306). The smallest significant negative correlation was observed between FV knowledge measured immediately after game playing and the importance of water and weight (r=-.308). The largest significant negative correlation was observed between water intake changes *after* game playing and self-efficacy for water (r=-.557).

9.2 Knowledge before and after game playing

A paired samples t-test showed that there was a significant increase in FV knowledge from baseline to one week *after* game playing, t (31) = -6.191, p = <.001.

10 Discussion

Findings of study 3 demonstrated a significant increase in FV knowledge from baseline to one week after game playing. Such findings support hypothesis 2 (There will be a significant increase in FV knowledge one week after game playing).

10.1 Game format

The knowledge increase observed may reflect the efficacy of a game-based approach to increase engagement, interaction and interest in FV properties. This finding supports previous research that has demonstrated the effects of intervention games on knowledge (Amaro et al, 2006; Peng, 2009; Orji, Vassileva & Mandryk, 2013; Orji, Vassileva & Mandryk, 2013).

Although the game format used in the present study was much simpler compared to previous studies that have adopted school-wide approaches (Jones et al, 2014; Jones, Madden & Wengreen,2014). The game format in study 3 adopted a real-world scenario that the student sample could relate to. Such an opportunity for enhanced perspective-taking as a result of a realistic narrative may have influenced the increased knowledge and intake observed (Grabowski, 2013).

Such an element may have increased engagement as this may have enabled participants to visualize themselves in the same scenario the game incorporated (i.e. choosing between a healthy and unhealthy food option). Such visualization, therefore, may also have been advantageous to increase FV consumption, as evidenced in the present study and in similar research (Pempek & Calvert, 2009, Peng, 2009). Furthermore, a sequential based game could have been utilized to examine sustained effects over time. The efficacy of a sequential email-based health has been demonstrated in past research (Franklin et al, 2006). However, in such research by Franklin et al (2006) participants were provided daily tips every weekday for 26 weeks. The content of the game tested in study 3 would be harder to implement for so many days. A weekly based approach may be more efficacious, however, in the last week of the intervention in research by Franklin et al (2006) 100% of the sample did not open all the emails they received.

10.2 Game content

The knowledge increase and the significant positive correlations between FV intake at baseline and one week *after* game playing observed in the present study suggests that the content of the game played by participants contained sufficient knowledge to prompt behaviour change. This finding supports previous research by Orji, Vassileva & Mandryk (2013). The knowledge content provided to participants in study 3 was similar to that used in previous research. In a physical activity and healthy eating intervention tested by Duncan et al (2014) participants were provided with the benefits of such behaviours and were also encouraged to self-monitor their behaviour and complete challenges incorporated into the intervention. As evidenced in study 2, self-monitoring had no effect on FV intake (i.e. the consumption levels of participants in study 2 were relatively low and did not substantially increase after the intervention, therefore it cannot be confirmed that the poster or self-monitoring of behaviour influenced intake). In conjunction with findings of study 3 the technology-based approach utilized by Duncan et al (2014) may have enabled a suitable level

of engagement to allow behaviour change. Study 3 did not provide challenges for participants to complete but provided participants with a behaviour option they could undertake (e.g. why not try meal A?). Although this was not explicitly described as a challenge, participants may have decided to try such healthy options in real life. Positive attitudes towards weight-loss text messages that included recipe tips have been observed in past research (Woolford et al, 2012). The perception of such behaviour options may have been perceived similarly to the challenges promoted by Duncan et al (2014) which could have influenced intake. Such an assumption therefore, would imply that the meal suggestions provided in study 3 contributed to behaviour change as opposed to the specific FV facts. In further research this could be verified via the measurement of consumption of the meals and FV mentioned in the game both before and after game playing. However, the lack of a significant correlation between FV knowledge and intake one week *after* game playing means that hypothesis 1(There will be a significant positive correlation between FV intake and knowledge one week *after* game playing) must be refuted. This finding may be representative of the extremely small sample size of study 3.

10.3 Future research

Future research could test the same game format on a weekly basis with varying healthy food choices for participants to select. Although an increase in consumption was observed in study 3, a weekly based longitudinal approach would enable verification of sustained behaviour change.

10.4 Limitations

Although the simplicity of the game tested in study 3 could be considered advantageous, it did not allow sophisticated graphics to increase the game "feel" of the intervention or to include visual representations of progress as in research by Nour, Rouf & Allman-Farinelli (2018). Although FV intake frequency data was collected, quantity/ portion size information was not, which may have influenced results. Similarly, longitudinal measures of knowledge retention and FV consumption would increase the validity of findings, as would a larger sample. The use of different scales used to measure FV intake before and after game playing was also a limitation of study 3. Although the scales were used to establish a general (baseline) and specific (*after* game playing) indication of intake, such scales may have confounded results.

11. General Discussion

11.1 Message Tone

A review of promotional campaigns aimed at increasing FV intake identified goal-setting and simple messages (Rekhy & McConchie, 2014) as effective components. In comparison to poster messages in study 2 ("you can eat…) the poster messages in study 1 adopted a more goal-setting, tone via the verb "eat" used directly and firmly. Participants may have perceived the tone of the poster messages utilized in study 2 as too soft and not strong enough to induce behaviour change. In the context of research by Rekhy & McConchie, 2014) participants may have been confused by the messages in study 2. This may have been because the messages may have been perceived as something they had no obligation to adhere to (i.e. they had a choice to engage in such behaviour, however, in study 1, the tone may have been perceived as something they had to adhere to). Similar, firm based-tones have produced similar effects in a text-messaging weight loss intervention by Brown, O'Connor & Savaiano (2014). Therefore, the increased efficacy of the interventions tested in study 1 compared to study 2, may have resulted from the tone adopted to communicate information. Although the provision of information in study 3 was less directive than study 1, the format and real-life scenario of the intervention tested may have influenced response to the knowledge provided. As previously discussed, the posters of study 1, placed in canteens, may have been more efficacious than the posters tested in study 2 due to the opportunity for customers to immediately change behaviour upon seeing the health promotion poster. Therefore, this could be considered as a variation on a habit-based intervention as in research by Rompotis, Grove & Byrne (2014). As such poster messages in study 1 were exposed to customers during a daily habit (lunchtime), this may have influenced results. In study 3 participants were provided with FV they could try during each meal of the day. The realistic nature of this game narrative, therefore, could have also influenced results through the habit-based information provision (i.e. the FV participants could try during each meal instead of the unhealthy options).

Although a prescriptive tone is easier to implement in physical activity health-promotions (Russell, Dzewaltowski & Ryan, 1999), elements could be utilized in healthy eating research. In the research by Russell, Dzewaltowski & Ryan (1999) reasons for use of the less physically active option were provided (lift use only for staff and physically challenged individuals). Previous poster research in a GP setting (Ward & Hawthrone, 1994) identified that 53% of individuals that noticed a health-promotion poster displayed in the GP waiting

room would be interested in more information. Therefore, if posters in the present study indicated that further information could be provided if necessary, poster effects may have been different over the two-week post-intervention period.

On the other hand, such differences in efficacy between study 1 and 2 could be based on gender differences. Alongside lack of motivation, Herbert et al (2010) also reported disbelief amongst males about the benefits of FV. Participants in study 2 were mainly female, whereas the gender of customers from study 1 was not verified.

11.2 Comparison of dietary recommendation and knowledge about FV

As observed in study 1 promotion of "1 extra" portion of FV appeared to be more efficacious than promotion of "5 portions". Such findings could be linked to the knowledge and intake increase observed in study 3. In study 3 participants were required to memorize short facts about particular FV. In relation to study 1, if participants knew a particular fact about a certain FV that is included in the dish of the day, for example, individuals may be more likely to eat "1 extra" portion. This may be because they can immediately undertake such behaviour and may feel more empowered as they are equipped with the knowledge about the particular FV they have chosen to eat. Further research in this area could combine the two elements from each study and monitor FV intake via a food diary (from study 2), to obtain accurate information about FV intake. On the other hand, studies 2 and 3 suggest that the population norm of FV intake is lower than recommendations for university students. This finding highlights the need for effective dietary interventions for students.

11.3 Co-occurrence of health-damaging behaviours

An additional factor that was not incorporated into the present studies is the co-occurrence of other health-damaging behaviours in conjunction with low FV. Kushida et al (2016) observed decreased FV intake amongst smokers. Such research may be indicative of the necessity for targeted language towards individuals with multiple health-risk behaviours (i.e. individuals that engage in multiple health-damaging may be less sensitive to particular language tones).

11.4 General limitations

Individuals with personal experience of the health condition in question (in studies 1, 2 and 3) may be more receptive to messages highlighting such issues as evidenced by Liberman & Chaiken (1992). This factor may influence differences within conditions. Additionally, the inclusion criteria for study 2 (university students) and the lack of inclusion criteria for study 3

may have influenced the effects observed. Examining more specific populations may have produced different findings.

12. Conclusion

To conclude, findings demonstrate the efficacy of interactive and non-interactive intervention elements om either FV intake or intentions. Successful non-interactive elements include non-habitual, novel language. Results suggest that implicit address of self-efficacy may not be strong enough to transform intentions into behaviour. Successful interactive elements include a real-world scenario and a game-based approach. Overall, results suggest that simple interventions that involve straight-forward narratives and simple cognitive processing would be most beneficial. A good understanding of the intervention message is essential to produce desired effects. Moreover, convenient and easy messages are advantageous for the workplace.

13. References

Alissa, E. M., & Ferns, G. A. (2017). Dietary fruits and vegetables and cardiovascular diseases risk. Critical Reviews In Food Science & Nutrition, 57(9), 1950-1962. doi:10.1080/10408398.2015.1040487

Amaro, S., Viggiano, A., Di Costanzo, A., Madeo, I., Viggiano, A., Baccari, M. E., & ... De Luca, B. (2006). Kalèdo, a new educational board-game, gives nutritional rudiments and encourages healthy eating in children: a pilot cluster randomized trial. European Journal Of Pediatrics, 165(9), 630-635.

Andersen, R. E., Franckowiak, S. C., Snyder, J., Bartlett, S. J., & Fontaine, K. R. (1998). Can Inexpensive Signs Encourage the Use of Stairs? Results from a Community Intervention. ANNALS OF INTERNAL MEDICINE, (5). 363.

Anschutz, D. J., Engels, R. C., & Van Strien, T. (2010). Maternal encouragement to be thin moderates the effect of commercials on children's snack food intake. *Appetite, 55*(1), 117-123.

Appelhans, B. M., French, S. A., Olinger, T., Bogucki, M., Janssen, I., Avery-Mamer, E. F., & Powell, L. M. (2018). Leveraging delay discounting for health: Can time delays influence food choice?. Appetite, 12616-25. doi:10.1016/j.appet.2018.03.010

Appleton, K. M: PhD Thesis (1999) University of Leeds.

Appleton, K. M. (2016). Greater fruit selection following an appearance-based compared with a health-based health promotion poster. Journal Of Public Health (Oxford, England), 38(4), 731-738. doi:10.1093/pubmed/fdv147

Appleton, K. M., Krumplevska, K., Smith, E., Rooney, C., McKinley, M. C., & Woodside, J. V. (2018). Low fruit and vegetable consumption is associated with low knowledge of the details of the 5-a-day fruit and vegetable message in the UK: findings from two cross-sectional questionnaire studies. *Journal of Human Nutrition and Dietetics*, *31*(1), 121-130.

Asakura, K., Todoriki, H., & Sasaki, S. (2017). Original Article: Relationship between nutrition knowledge and dietary intake among primary school children in Japan: Combined effect of children's and their guardians' knowledge. Journal Of Epidemiology, 27483-491. doi:10.1016/j.je.2016.09.014

Ashton, L. M., Hutchesson, M. J., Rollo, M. E., Morgan, P. J., Thompson, D. I., & Collins, C. E. (2015). Young adult males' motivators and perceived barriers towards eating healthily and being active: a qualitative study. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 93

Ashton, L. M., Hutchesson, M. J., Rollo, M. E., Morgan, P. J., & Collins, C. E. (2017). Motivators and Barriers to Engaging in Healthy Eating and Physical Activity. American Journal Of Men's Health, 11(2), 330-343. doi:10.1177/1557988316680936

Aubrey, J. S. (2010). Looking good versus feeling good: An investigation of media frames of health advice and their effects on women's body-related self-perceptions. *Sex Roles*, *63*(1-2), 50-63.

Aune, D., Giovannucci, E., Boffetta, P., Fadnes, L. T., Keum, N., Norat, T., & ... Tonstad, S. (2017). Fruit and vegetable intake and the risk of cardiovascular disease, total cancer and all-cause mortality-a systematic review and dose-response meta-analysis of prospective studies. International Journal Of Epidemiology, 46(3), 1029. doi:10.1093/ije/dyw319

Bailey, R., Wise, K., & Bolls, P. (2009). How avatar customizability affects children's arousal and subjective presence during junk food–sponsored online video games. *CyberPsychology & Behavior*, *12*(3), 277-283.

Bandoni, D. H., Sarno, F., & Jaime, P. C. (2011). Impact of an intervention on the availability and consumption of fruits and vegetables in the workplace. *Public health nutrition*, *14*(6), 975-981.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191.

Bannon, K., & Schwartz, M. B. (2006). Impact of nutrition messages on children's food choice: pilot study. Appetite, 46(2), 124-129

Barlett, C. P., Vowels, C. L., & Saucier, D. A. (2008). Meta-analyses of the effects of media images on men's body-image concerns. Journal Of Social And Clinical Psychology, 27(3), 279-310. doi:10.1521/jscp.2008.27.3.279

Benedikt, R., Wertheim, E. H., & Love, A. (1998). Eating attitudes and weight-loss attempts in female adolescents and their mothers. *Journal of Youth and Adolescence*, *27*(1), 43-57.

Blake H. & Patterson J. (2015) Paediatric nurses' attitudes towards the promotion of healthy eating. British Journal of Nursing 24(2), 108–112.

Boland, W. A., Connell, P. M., & Vallen, B. (2013). Time of day effects on the regulation of food consumption after activation of health goals. *Appetite, 70*, 47-52.

Bright, L., & Daugherty, T. (2012). Does customization impact advertising effectiveness? An exploratory study of consumer perceptions of advertising in customized online environments. Journal Of Marketing Communications, 18(1), 19-37. doi:10.1080/13527266.2011.620767

Brown, O. N., O'Connor, L. E., & Savaiano, D. (2014). Mobile MyPlate: A pilot study using text messaging to provide nutrition education and promote better dietary choices in college students. Journal Of American College Health, 62(5), 320-327. doi:10.1080/07448481.2014.899233

Brug, J., de Vet, E., de Nooijer, J., & Verplanken, B. (2006). Predicting fruit consumption: cognitions, intention, and habits. *Journal of Nutrition Education and Behavior*, *38*(2), 73-81.

Bull, E. R., Dombrowski, S. U., McCleary, N., & Johnston, M. (2014). Are interventions for low-income groups effective in changing healthy eating, physical activity and smoking behaviours? A systematic review and meta-analysis. *BMJ open*, *4*(11), e006046.

Byrne, S., Gay, G., Pollack, J. P., Gonzales, A., Retelny, D., Lee, T., & Wansink, B. (2012). Caring for Mobile Phone-Based Virtual Pets can Influence Youth Eating Behaviors. Journal Of Children & Media, 6(1), 83. doi:10.1080/17482798.2011.633410

Campbell, M. K., Tessaro, I., DeVellis, B., Benedict, S., Kelsey, K., Belton, L., & Sanhueza, A. (2002). Effects of a tailored health promotion program for female blue-collar workers: health works for women. *Preventive medicine*, *34*(3), 313-323.

Caperchione, C. M., Vandelanotte, C., Kolt, G. S., Duncan, M., Ellison, M., George, E., & Mummery, W. K. (2012). What a man wants: understanding the challenges and motivations to physical activity participation and healthy eating in middle-aged Australian men. American Journal Of Men's Health, 6(6), 453-461. doi:10.1177/1557988312444718

Carfora, V., Caso, D., & Conner, M. (2016). Randomized controlled trial of a messaging intervention to increase fruit and vegetable intake in adolescents: Affective versus instrumental messages. British Journal Of Health Psychology, 21(4), 937-955. doi:10.1111/bjhp.12208

Cerin, E., Barnett, A., & Baranowski, T. (2009). Testing theories of dietary behavior change in youth using the mediating variable model with intervention programs. *Journal of nutrition education and behavior*, *41*(5), 309-318.

Churchill, S., & Pavey, L. (2013). Promoting fruit and vegetable consumption: The role of message framing and autonomy. British Journal of Health Psychology, 18, 610–622. doi:10.1111/ bjhp.12007

Cohen, R., Newton-John, T., & Slater, A. (2017). The relationship between Facebook and Instagram appearance-focused activities and body image concerns in young women. Body Image, 23183-187. doi:10.1016/j.bodyim.2017.10.002

Colón-Ramos, U., Finney Rutten, L. J., Moser, R. P., Colón-Lopez, V., Ortiz, A. P., & Yaroch, A. L. (2015). The association between fruit and vegetable intake, knowledge of the recommendations, and health information seeking within adults in the U.S. mainland and in Puerto Rico. Journal Of Health Communication, 20(1), 105-111. doi:10.1080/10810730.2014.914607

Conner, T. S., Brookie, K. L., Richardson, A. C., & Polak, M. A. (2015). On carrots and curiosity: eating fruit and vegetables is associated with greater flourishing in daily life. *British Journal of Health Psychology*, *20*(2), 413-427.

Cook, C., Swinburn, B., & Stewart, J. (2001). Changing risk behaviours for non-communicable disease in New Zealand working men-is workplace intervention effective?. *New Zealand Medical Journal*, *114*(1130), 175-178.

Coulthard, H., & Ahmed, S. (2016). Non-taste exposure techniques to increase fruit and vegetable (FV) acceptance in children: The effects of gamification and FV stimuli. Appetite, 107679. doi:10.1016/j.appet.2016.08.030

Coulthard, H., & Sealy, A. (2017). Play with your food! Sensory play is associated with tasting of fruits and vegetables in preschool children. Appetite, 11384-90. doi:10.1016/j.appet.2017.02.003

Coulthard, H., Williamson, I., Palfreyman, Z., & Lyttle, S. (2018). Evaluation of a pilot sensory play intervention to increase fruit acceptance in preschool children. *Appetite*, *120*, 609-615.Dawson, J., Dwyer, J. J., Evers, S., & Sheeshka, J. (2006). Eat smart! Workplace cafeteria program evaluation of the nutrition component. *Canadian Journal of Dietetic Practice and Research*, *67*(2), 85-90

de Bruijn, G., & Budding, J. (2016). Temporal Consequences, Message Framing, and Consideration of Future Consequences: Persuasion Effects on Adult Fruit Intake Intention and Resolve. Journal Of Health Communication, 21(8), 944-953. doi:10.1080/10810730.2016.1179366

Dearden, K. A., Hilton, S., Bentley, M. E., Caulfield, L. E., Wilde, C., Ha, P. B., & Marsh, D. (2009). Caregiver verbal encouragement increases food acceptance among Vietnamese toddlers. *The Journal of nutrition*, *139*(7), 1387-1392.

Deliens, T., Clarys, P., De Bourdeaudhuij, I., & Deforche, B. (2014). Determinants of eating behaviour in university students: a qualitative study using focus group discussions. BMC Public Health, 1453. doi:10.1186/1471-2458-14-53

Dijkstra, S. C., Neter, J. E., Brouwer, I. A., Huisman, M., Visser, M., van Lenthe, F. J., & Kamphuis, C. B. (2018). Socio-economic differences in the change of fruit and vegetable intakes among Dutch adults between 2004 and 2011: the GLOBE study. *Public Health Nutrition*, 1-13.

Dijkstra, A., Rothman, A., & Pietersma, S. (2011). The persuasive effects of framing messages on fruit and vegetable consumption according to regulatory focus theory. Psychology & Health, 26(8), 1036-1048. doi:10.1080/08870446.2010.526715

Duan, Y. P., Wienert, J., Hu, C., Si, G. Y., & Lippke, S. (2017). Web-Based Intervention for Physical Activity and Fruit and Vegetable Intake Among Chinese University Students: A Randomized Controlled Trial. Journal Of Medical Internet Research, 19(4), e106. doi:10.2196/jmir.7152

Duncan, M., Vandelanotte, C., Kolt, G. S., Rosenkranz, R. R., Caperchione, C. M., George, E. S., ... & Noakes, M. (2014). Effectiveness of a web-and mobile phone-based intervention to promote physical activity and healthy eating in middle-aged males: randomized controlled trial of the ManUp study. *Journal of medical Internet research*, *16*(6).

Dutta-Bergman, M. J. (2004). A descriptive narrative of healthy eating: A social marketing approach using psychographics in conjunction with interpersonal, community, mass media and new media activities. *Health marketing quarterly*, *20*(3), 81-101.

Eikenberry, N., & Smith, C. (2004). Healthful eating: perceptions, motivations, barriers, and promoters in low-income Minnesota communities. Journal Of The American Dietetic Association, 104(7), 1158-1161.

El Ansari, W., Stock, C., John, J., Deeny, P., Phillips, C., Snelgrove, S., & ... Mabhala, A. (2011). Health promoting behaviours and lifestyle characteristics of students at seven universities in the UK. Central European Journal Of Public Health, 19(4), 197-204.

Engbers, L. H., van Poppel, M. N., Paw, M. C. A., & van Mechelen, W. (2006). The effects of a controlled worksite environmental intervention on determinants of dietary behavior and self-reported fruit, vegetable and fat intake. *BMC Public Health*, *6*(1), 253.

Erinosho, T. O., Moser, R. P., Oh, A. Y., Nebeling, L. C., & Yaroch, A. L. (2012). Awareness of the Fruits and Veggies-More Matters campaign, knowledge of the fruit and vegetable recommendation, and fruit and vegetable intake of adults in the 2007 Food Attitudes and Behaviors (FAB) Survey. Appetite, 59(1), 155-160. doi:10.1016/j.appet.2012.04.010

Evans, R., Kawabata, M., & Thomas, S. (2015). Prediction of fruit and vegetable intake: The importance of contextualizing motivation. British Journal Of Health Psychology, 20(3), 534-548. doi:10.1111/bjhp.12123

Fernández, B. R., Warner, L. M., Knoll, N., Montenegro, E. M., & Schwarzer, R. (2015). Synergistic effects of social support and self-efficacy on dietary motivation predicting fruit and vegetable intake. *Appetite*, *87*, 330-335.

Fielder-Jenks, C. R. (2010). Can Health Behaviors and Motives Predict College Students' Self-Esteem?. Psi Chi Journal Of Undergraduate Research, 15(3), 143-149.

Fitzgerald, A., Heary, C., Kelly, C., Nixon, E., & Shevlin, M. (2013). Self-efficacy for healthy eating and peer support for unhealthy eating are associated with adolescents' food intake patterns. Appetite, 6348-58. doi:10.1016/j.appet.2012.12.011

Ford, P. A., Jaceldo-Siegl, K., Lee, J. W., Youngberg, W., & Tonstad, S. (2013). Intake of Mediterranean foods associated with positive affect and low negative affect. Journal Of Psychosomatic Research, 74(2), 142-148. doi:10.1016/j.jpsychores.2012.11.002

Franklin, P. D., Rosenbaum, P. F., Carey, M. P., & Roizen, M. F. (2006). Using sequential email messages to promote health behaviors: Evidence of feasibility and reach in a worksite sample. *Journal of Medical Internet Research*, *8*(1).

Franko, D. L., Cousineau, T. M., Trant, M., Green, T. C., Rancourt, D., Thompson, D., & ... Ciccazzo, M. (2008). Motivation, self-efficacy, physical activity and nutrition in college students: Randomized controlled trial of an internet-based education program. PREVENTIVE MEDICINE, (4). 369.

Freeman, B., Kelly, B., Baur, L., Chapman, K., Chapman, S., Gill, T., & King, L. (2014). Digital junk: food and beverage marketing on Facebook. American Journal Of Public Health, 104(12), e56-e64. doi:10.2105/AJPH.2014.302167

Gebremariam, M. K., Henjum, S., Terragni, L., & Torheim, L. E. (2016). Correlates of fruit, vegetable, soft drink, and snack intake among adolescents: the ESSENS study. *Food & nutrition research*, *60*(1), 32512.

Grabowski, D. (2013). Health Identity, Participation and Knowledge: A Qualitative Study of a Computer Game for Health Education among Adolescents in Denmark. Health Education Journal, 72(6), 761-768.

Gorman, P. (2004). *Motivation and emotion*. Routledge.

Greaney, M. L., Less, F. D., White, A. A., Dayton, S. F., Riebe, D., Blissmer, B., & ... Greene, G. W. (2009). College students' barriers and enablers for healthful weight management: a qualitative study. Journal Of Nutrition Education And Behavior, 41(4), 281-286. doi:10.1016/j.jneb.2008.04.354

Hearty, A. P., McCarthy, S. N., Kearney, J. M., & Gibney, M. J. (2007). Relationship between attitudes towards healthy eating and dietary behaviour, lifestyle and demographic factors in a representative sample of Irish adults. *Appetite*, *48*(1), 1-11.

Geaney, F., Harrington, J., Fitzgerald, A. P., & Perry, I. J. (2011). The impact of a workplace catering initiative on dietary intakes of salt and other nutrients: a pilot study. *Public health nutrition*, *14*(8), 1345-1349.

Geaney, F., Kelly, C., Di Marrazzo, J. S., Harrington, J. M., Fitzgerald, A. P., Greiner, B. A., & Perry, I. J. (2016). The effect of complex workplace dietary interventions on employees' dietary intakes, nutrition knowledge and health status: a cluster controlled trial. *Preventive medicine*, *89*, 76-83.

Gerber, B. S., Stolley, M. R., Thompson, A. L., Sharp, L. K., & Fitzgibbon, M. L. (2009). Mobile phone text messaging to promote healthy behaviors and weight loss maintenance: a feasibility study. *Health informatics journal*, *15*(1), 17-25

Gerend, M. A., & Maner, J. K. (2011). Fear, anger, fruits, and veggies: Interactive effects of emotion and message framing on health behavior. *Health Psychology*, *30*(4), 420.

Ghadimi, S., Seraj, B., Keshavarz, H., Shamshiri, A. R., & Abiri, R. (2014). The Effect of Using an Educational Poster on Elementary School Health Teachers' Knowledge of Emergency Management of Traumatic Dental Injuries. *Journal of dentistry (Tehran, Iran)*, *11*(6), 620.

Giese, H., König, L. M., Tăut, D., Ollila, H., Băban, A., Absetz, P., & ... Renner, B. (2015). Exploring the association between television advertising of healthy and unhealthy foods, self-control, and food intake in three European countries. Applied Psychology: Health And Well-Being, 7(1), 41-62. doi:10.1111/aphw.12036

Gorn, G. J., & Goldberg, M. E. (1982). Behavioral evidence of the effects of televised food messages on children. *Journal of consumer research*, *9*(2), 200-205.

Gough, B., & Conner, M. T. (2006). Barriers to healthy eating amongst men: a qualitative analysis. Social Science & Medicine (1982), 62(2), 387-395.

Grabe, S., Ward, L. M., & Hyde, J. S. (2008). The role of the media in body image concerns among women: a meta-analysis of experimental and correlational studies. Psychological Bulletin, 134(3), 460-476. doi:10.1037/0033-2909.134.3.460

Hammerback, K., Hannon, P. A., Harris, J. R., Clegg-Thorp, C., Kohn, M., & Parrish, A. (2015). Perspectives on Workplace Health Promotion Among Employees in Low-Wage Industries. American Journal Of Health Promotion, 29(6), 384-392.

Hansen, A. R., Alfonso, M. L., Hackney, A. A., & Luque, J. S. (2015). Preschool children's self-reports of fruit and vegetable knowledge, preference, and messages encouraging consumption. The Journal Of School Health, 85(6), 355-364. doi:10.1111/josh.12260

Herbert, G., Butler, L., Kennedy, O., & Lobb, A. (2010). Young UK adults and the 5 A DAY campaign: Perceived benefits and barriers of eating more fruits and vegetables. International Journal Of Consumer Studies, 34(6), 657-664. doi:10.1111/j.1470-6431.2010.00872.x

Hesketh, K., Waters, E., Green, J., Salmon, L., & Williams, J. (2005). Healthy eating, activity and obesity prevention: a qualitative study of parent and child perceptions in Australia. *Health promotion international*, *20*(1), 19-26.

Holdsworth, M., & Haslam, C. (1998). A review of point-of-choice nutrition labelling schemes in the workplace, public eating places and universities. *Journal of Human Nutrition and Dietetics*, *11*(5), 423-445.

Huntsinger, E. T., & Luecken, L. J. (2004). Attachment Relationships and Health Behavior: The Mediational Role of Self-esteem. PSYCHOLOGY AND HEALTH, (4). 515.

Iversen, M. K., Händel, M. N., Jensen, E. N., Frederiksen, P., & Heitmann, B. L. (2007). Effect of health-promoting posters placed on the platforms of two train stations in Copenhagen, Denmark, on the choice between taking the stairs or the escalators: a secondary publication. International Journal Of Obesity (2005), 31(6), 950-955.

Jones, S. C., & Kervin, L. (2011). An experimental study on the effects of exposure to magazine advertising on children's food choices. *Public health nutrition*, *14*(8), 1337-1344.

Jones, B. A., Madden, G. J., Wengreen, H. J., Aguilar, S. S., & Desjardins, E. A. (2014). Gamification of dietary decision-making in an elementary-school cafeteria. *PLoS One*, *9*(4), e93872.

Katz, D. L., O'Connell, M., Yeh, M., Nawaz, H., Njike, V., Anderson, L. M., & ... Dietz, W. (2005). Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. MMWR. Recommendations And Reports: Morbidity And Mortality Weekly Report. Recommendations And Reports, 54(RR-10), 1-12.

Kinard, B. R. (2016). Insta-Grams: The Effect of Consumer Weight on Reactions to Healthy Food Posts. Cyberpsychology, Behavior & Social Networking, 19(8), 481-486. doi:10.1089/cyber.2016.0085

Kreuter, M. W., Sugg-Skinner, C., Holt, C. L., Clark, E. M., Haire-Joshu, D., Fu, Q., ... & Bucholtz, D. (2005). Cultural tailoring for mammography and fruit and vegetable intake among low-income African-American women in urban public health centers. *Preventive medicine*, *41*(1), 53-62.

Kuijer, R. G., & Boyce, J. A. (2014). Research report: Chocolate cake. Guilt or celebration? Associations with healthy eating attitudes, perceived behavioural control, intentions and weight-loss. Appetite, 7448-54. doi:10.1016/j.appet.2013.11.013

Kumar, G. S., Bryan, M., Bayakly, R., Drenzek, C., Merlo, C., & Perry, G. S. (2017). Reported Motivations for and Locations of Healthy Eating among Georgia High School Students. Journal Of School Health, 87(5), 353-362.

Kushida, O., Iriyama, Y., Murayama, N., Saito, T., & Yoshita, K. (2017). Associations of self-efficacy, social support, and knowledge with fruit and vegetable consumption in Japanese workers. Asia Pacific Journal Of Clinical Nutrition, (4), 725.

LaCaille, L. J., Dauner, K. N., Krambeer, R. J., & Pedersen, J. (2011). Psychosocial and environmental determinants of eating behaviors, physical activity, and weight change among college students: a qualitative analysis. *Journal of American College Health*, *59*(6), 531-538.

Lappalainen, R., Saba, A., Holm, L., Mykkanen, H., Gibney, M. J., & Moles, A. (1997). Difficulties in trying to eat healthier: descriptive analysis of perceived barriers for healthy eating. *European journal of clinical nutrition*, *51*(2), S36.

LaRose, J. G., Leahey, T. M., Hill, J. O., & Wing, R. R. (2013). Differences in motivations and weight loss behaviors in young adults and older adults in the National Weight Control Registry. *Obesity*, *21*(3), 449-453.

Larson, N. I., Perry, C. L., Story, M., & Neumark-Sztainer, D. (2006). Food preparation by young adults is associated with better diet quality. *Journal of the American dietetic association*, *106*(12), 2001-2007.

Linnan, L. A., Ferguson, Y. O., Wasilewski, Y., Lee, A. M., Yang, J., Solomon, F., & Katz, M. (2005). Using community-based participatory research methods to reach women with health messages: results from the North Carolina BEAUTY and Health Pilot Project. Health Promotion Practice, 6(2), 164-173.

Larson, N., Laska, M. N., Story, M., & Neumark-Sztainer, D. (2012). Predictors of fruit and vegetable intake in young adulthood. Journal Of The Academy Of Nutrition And Dietetics, 112(8), 1216-1222. doi:10.1016/j.jand.2012.03.035

Latimer, A. E., Williams-Piehota, P., Katulak, N. A., Cox, A., Mowad, L., Higgins, E. T., & Salovey, P. (2008). Promoting fruit and vegetable intake through messages tailored to individual differences in regulatory focus. *Annals of Behavioral Medicine*, *35*(3), 363-369.

Lee, M, Yoonhyeung, C., Quilliam, E. T., & Cole, R. T. (2009). Playing With Food: Content Analysis of Food Advergames. Journal Of Consumer Affairs, 43(1), 129-154. doi:10.1111/j.1745-6606.2008.01130.x

Liberman, A., & Chaiken, S. (1992). Defensive processing of personally relevant health messages. Personality and Social Psychology Bulletin, 18, 669-679. doi:10.1177/0146167292186002

Long, J. D., & Stevens, K. R. (2004). Using technology to promote self-efficacy for healthy eating in adolescents. *Journal of Nursing Scholarship*, *36*(2), 134-139.

Lucas, J. A., Orshan, S. A., & Cook, F. (2000). Determinants of health-promoting behavior among women ages 65 and above living in the community. *Research and Theory for Nursing Practice*, *14*(1), 77-100.

Luszczynska, A., Horodyska, K., Zarychta, K., Liszewska, N., Knoll, N., & Scholz, U. (2016). Planning and self-efficacy interventions encouraging replacing energy-dense foods intake with fruit and vegetable: A longitudinal experimental study. Psychology & Health, (1), 40.

Luszczynska, A., Tryburcy, M., & Schwarzer, R. (2006). Improving fruit and vegetable consumption: a self-efficacy intervention compared with a combined self-efficacy and planning intervention. *Health Education Research*, *22*(5), 630-638.

Mackert, M., Lazard, A., Champlin, S., Liang, M., Mabry, A., Stroever, S., & ... Watkins, L. (2014). Practice forum: “Take time. Save lives. Clean hands protect.” A comparison of two hand hygiene health promotion posters. AJIC: American Journal Of Infection Control, 42530-532. doi:10.1016/j.ajic.2014.01.017

Marquis, M. (2005). Exploring convenience orientation as a food motivation for college students living in residence halls. *International Journal of Consumer Studies*, *29*(1), 55-63

McGee, R. O. B., & Williams, S. (2000). Does low self-esteem predict health compromising behaviours among adolescents?. Journal of adolescence, 23(5), 569-582.

McMartin, S. E., Jacka, F. N., & Colman, I. (2013). The association between fruit and vegetable consumption and mental health disorders: evidence from five waves of a national survey of Canadians. *Preventive medicine*, *56*(3-4), 225-230.

Morgan, P. J., Collins, C. E., Plotnikoff, R. C., Cook, A. T., Berthon, B., Mitchell, S., & Callister, R. (2011). Efficacy of a workplace-based weight loss program for overweight male shift workers: the Workplace POWER (Preventing Obesity Without Eating like a Rabbit) randomized controlled trial. *Preventive medicine*, *52*(5), 317-325.

Morse, K. L., & Driskell, J. A. (2009). Observed sex differences in fast-food consumption and nutrition self-assessments and beliefs of college students. Nutrition Research (New York, N.Y.), 29(3), 173-179. doi:10.1016/j.nutres.2009.02.004

Müller, A. M., Alley, S., Schoeppe, S., & Vandelanotte, C. (2016). The effectiveness of e-& mHealth interventions to promote physical activity and healthy diets in developing countries: A systematic review. The International Journal Of Behavioral Nutrition And Physical Activity, 13(1), 109.

Mummah, S., Robinson, T. N., Mathur, M., Farzinkhou, S., Sutton, S., & Gardner, C. D. (2017). Effect of a mobile app intervention on vegetable consumption in overweight adults: a randomized controlled trial. International Journal Of Behavioral Nutrition & Physical Activity, 141. doi:10.1186/s12966-017-0563-2

Munt, A. E., Partridge, S. R., & Allman-Farinelli, M. (2017). The barriers and enablers of healthy eating among young adults: a missing piece of the obesity puzzle: A scoping

review. Obesity Reviews: An Official Journal Of The International Association For The Study Of Obesity, 18(1), 1-17. doi:10.1111/obr.12472

Musaiger, A. O., Al-Mannai, M., Tayyem, R., Al-Lalla, O., Ali, E. Y., Kalam, F., ... & Chirane, M. (2013). Perceived barriers to healthy eating and physical activity among adolescents in seven Arab countries: a cross-cultural study. *The Scientific World Journal*, *2013*.

Nagler, R. H. (2014). Adverse outcomes associated with media exposure to contradictory nutrition messages. *Journal of health communication*, *19*(1), 24-40.

Napolitano, M. A., Hayes, S., Bennett, G. G., Ives, A. K., & Foster, G. D. (2013). Using Facebook and text messaging to deliver a weight loss program to college students. *Obesity*, *21*(1), 25-31.

Norman, G. J., Kolodziejczyk, J. K., Adams, M. A., Patrick, K., & Marshall, S. J. (2013). Fruit and vegetable intake and eating behaviors mediate the effect of a randomized text-message based weight loss program. Preventive Medicine, 563-7. doi:10.1016/j.ypmed.2012.10.012

McGee, R. O. B., & Williams, S. (2000). Does low self-esteem predict health compromising behaviours among adolescents?. Journal of adolescence, 23(5), 569-582.

Nour, M. M., Rouf, A. S., & Allman-Farinelli, M. (2018). Exploring young adult perspectives on the use of gamification and social media in a smartphone platform for improving vegetable intake. *Appetite*, *120*, 547-556.

Nyquist, H., Rhee, Y., Brunt, A., & Garden-Robinson, J. (2011). Promoting Healthy Eating and Exercise through Online Messages: A Pilot Study. Journal Of Extension, 49(6)

Odum, M., Housman, J. M., Williams, J. D., Bishop, J. M., & Burson, S. (2016). Predicting U.S Adolescent fruit and vegetable consumption: Which socio-ecological factors matter? American Journal Of Health Studies, 31(4), 213-221.

Ogunsile, S. E., & Ogundele, B. O. (2016). Effect of game-enhanced nutrition education on knowledge, attitude and practice of healthy eating among adolescents in Ibadan, Nigeria. International Journal Of Health Promotion & Education, 54(5), 207-216. doi:10.1080/14635240.2016.1157509

O'keefe, D. J., & Jensen, J. D. (2006). The advantages of compliance or the disadvantages of noncompliance? A meta-analytic review of the relative persuasive effectiveness of gain-framed and loss-framed messages. *Annals of the International Communication Association*, *30*(1), 1-43.

Oluwakanyinsola Ojuolape, S., Olayinka O, A., & Tinuola O, O. (2017). Knowledge and consumption of fruits and vegetables among secondary school students of Obele Community Junior High School, Surulere, Lagos State, Nigeria. Journal Of Clinical Sciences, Vol 14, Iss 2, Pp 68-73 (2017), (2), 68. doi:10.4103/jcls.jcls_60_16

Orji, R., Vassileva, J., & Mandryk, R. L. (2013). LunchTime: a slow-casual game for long-term dietary behavior change. *Personal and Ubiquitous Computing*, *17*(6), 1211-1221.

Papadaki, A., & Scott, J. A. (2005). Process evaluation of an innovative healthy eating website promoting the Mediterranean diet. *Health education research*, *21*(2), 206-218Patrick, K., Raab, F., Adams, M. A., Dillon, L., Zabinski, M., Rock, C. L., ... &

Norman, G. J. (2009). A text message–based intervention for weight loss: randomized controlled trial. *Journal of medical Internet research*, *11*(1).

Payán, D. D., Sloane, D. C., Illum, J., Farris, T., & Lewis, L. B. (2017). Perceived Barriers and Facilitators to Healthy Eating and School Lunch Meals among Adolescents: A Qualitative Study. American Journal Of Health Behavior, 41(5), 661-669. doi:10.5993/AJHB.41.5.15

Pedersen, S., Grønhøj, A., & Thøgersen, J. j. (2016). Texting your way to healthier eating? Effects of participating in a feedback intervention using text messaging on adolescents' fruit and vegetable intake. Health Education Research, 31(2), 171-184. doi:10.1093/her/cyv104

Pempek, T. A., & Calvert, S. L. (2009). Tipping the balance: use of advergames to promote consumption of nutritious foods and beverages by low-income African American children. Archives Of Pediatrics & Adolescent Medicine, 163(7), 633-637. doi:10.1001/archpediatrics.2009.71

Peng, W. (2008). The mediational role of identification in the relationship between experience mode and self-efficacy: Enactive role-playing versus passive observation.

Cyberpsychology & Behavior: The Impact Of The Internet, Multimedia And Virtual Reality On Behavior And Society, 11(6), 649-652. doi:10.1089/cpb.2007.0229

Peng, W. (2009). Design and evaluation of a computer game to promote a healthy diet for young adults. Health Communication, 24(2), 115-127. doi:10.1080/10410230802676490

Petty, R. E., & Cacioppo, J. T. (1986a). Communication and persuasion: Central and peripheral routes to attitude change. New York: Springer-Verlag.

Phiri L.P., Draper C.E., Lambert E.V. & Kolbe-Alexander T.L. (2014) Nurses' lifestyle behaviours, health priorities and barriers to living a healthy lifestyle: a qualitative descriptive study. BMC Nursing, 13(1), 38.

Plotnikoff, R. C., McCargar, L. J., Wilson, P. M., & Loucaides, C. A. (2005). Efficacy of an E-mail intervention for the promotion of physical activity and nutrition behavior in the workplace context. *American Journal of Health Promotion*, *19*(6), 422-429.

Pollard, J., Greenwood, D., Kirk, S., & Cade, J. (2002). Motivations for fruit and vegetable consumption in the UK Women's Cohort Study. *Public health nutrition*, *5*(3), 479-486.

Portnoy, D. B., Scott-Sheldon, L. J., Johnson, B. T., & Carey, M. P. (2008). Computer-delivered interventions for health promotion and behavioral risk reduction: a meta-analysis of 75 randomized controlled trials, 1988-2007. Preventive Medicine, 47(1), 3-16. doi:10.1016/j.ypmed.2008.02.014

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American psychologist*, *47*(9), 1102.

Puhl, R., Peterson, J. L., & Luedicke, J. (2013). Fighting obesity or obese persons? Public perceptions of obesity-related health messages. *International Journal of Obesity*, *37*(6), 774.

Reeves, B., Cummings, J. J., Scarborough, J. K., & Yeykelis, L. (2015). Increasing energy efficiency with entertainment media: An experimental and field test of the influence of a social game on performance of energy behaviors. Environment And Behavior, 47(1), 102-115. doi:10.1177/0013916513506442

Rekhy, R., & McConchie, R. (2014). Promoting consumption of fruit and vegetables for better health. Have campaigns delivered on the goals?. *Appetite*, *79*, 113-123.

Rompotis, C. J., Grove, J. R., & Byrne, S. M. (2014). Benefits of habit-based informational interventions: a randomised controlled trial of fruit and vegetable consumption. Australian & New Zealand Journal Of Public Health, 38(3), 247-252. doi:10.1111/1753-6405.12232

Rooney, C., McKinley, M. C., Appleton, K. M., Young, I. S., McGrath, A. J., Draffin, C. R., & ... Woodside, J. V. (2017). How much is '5-a-day'? A qualitative investigation into consumer understanding of fruit and vegetable intake guidelines. Journal Of Human Nutrition And Dietetics, 30(1), 105-113. doi:10.1111/jhn.12393

Rosenberg, M. (1965). Society and the adolescent self-image. Princeton, NJ: Princeton University Press.

Rosi, A., Zerbini, C., Pellegrini, N., Scazzina, F., Brighenti, F., & Lugli, G. (2017). How to improve food choices through vending machines: the importance of healthy food availability and consumers' awareness. *Food Quality and Preference*

Rothman, A. J., Bartels, R. D., Wlaschin, J., & Salovey, P. (2006). The strategic use of gain- and loss-framed messages to promote healthy behavior: How theory can inform practice. *Journal of communication*, *56*(suppl_1), S202-S220.

Rusmevichientong, P., Streletskaya, N. A., Amatyakul, W., & Kaiser, H. M. (2014). The impact of food advertisements on changing eating behaviors: An experimental study. Food Policy, 4459-67. doi:10.1016/j.foodpol.2013.10.011

Satia, J., Barlow, J., Armstrong-Brown, J., & Watters, J. (2010). Qualitative study to explore prospect theory and message framing and diet and cancer prevention -- related issues among African American adolescents. Cancer Nursing, 33(2), 102-109. doi:10.1097/NCC.0b013e3181be5e8a

Schwartz, M. B. (2007). The influence of a verbal prompt on school lunch fruit consumption: a pilot study. *International Journal of Behavioral Nutrition and Physical Activity*, *4*(1), 6.

Scully, M., Wakefield, M., Niven, P., Chapman, K., Crawford, D., Pratt, I., & ... Morley, B. (2012). Association between food marketing exposure and adolescents' food choices and eating behaviors. Appetite, 58(1), 1-5. doi:10.1016/j.appet.2011.09.020

Shaikh AR, Yaroch AL, Nebeling L, Yeh MC, Resnicow K. Psychosocial predictors of fruit and vegetable consumption in adults a review of the literature. Am J Prev Med. 2008;34: 535-43. doi: 10.1016/j.amepre. 2007.12.028.

Shepherd, J., Harden, A., Rees, R., Brunton, G., Garcia, J., Oliver, S., & Oakley, A. (2001). Young people and healthy eating: a systematic review of research on barriers and facilitators.

Shrestha, A., Pyakurel, P., Shrestha, A., Gautam, R., Manandhar, N., Rhodes, E., & ... Spiegelman, D. (2017). Facilitators and barriers to healthy eating in a worksite cafeteria: a qualitative study from Nepal. Heart Asia, 9(2), e010956. doi:10.1136/heartasia-2017-010956

Sieverding, M., & Scheiter, F. (2012). Aktueller und erwünschter Obst-und Gemüsekonsum bei Studierenden. *Zeitschrift für Gesundheitspsychologie*.

Siopis, G., Chey, T., & Allman-Farinelli, M. (2015). A systematic review and meta-analysis of interventions for weight management using text messaging. *Journal of human nutrition and dietetics*, *28*(s2), 1-15.

Sirois, F. M. (2004). Procrastination and intentions to perform health behaviors: The role of self-efficacy and the consideration of future consequences. *Personality and Individual differences*, *37*(1), 115-128.

Sirois, F. M., Melia-Gordon, M. L., & Pychyl, T. A. (2003). “I'll look after my health, later”: An investigation of procrastination and health. *Personality and Individual Differences*, *35*(5), 1167-1184.

Slavin, J. L., & Lloyd, B. (2012). Health benefits of fruits and vegetables. *Advances in nutrition*, *3*(4), 506-516.

Stirin Tzur, K., Ganzach, Y., & Pazy, A. (2016). On the positive and negative effects of self-efficacy on performance: Reward as a moderator. *Human Performance*, *29*(5), 362-377.

Stites, S. D., Singletary, S. B., Menasha, A., Cooblall, C., Hantula, D., Axelrod, S., ... & Phipps, E. J. (2015). Pre-ordering lunch at work. Results of the what to eat for lunch study. *Appetite*, *84*, 88-97.

Stöckli, S., Stämpfli, A. E., Messner, C., & Brunner, T. A. (2016). An (un) healthy poster: When environmental cues affect consumers' food choices at vending machines. *Appetite*, *96*, 368-374.

Sok, S. R., & Yun, E. K. (2011). A comparison of physical health status, self-esteem, family support and health-promoting behaviours between aged living alone and living with family in Korea. Journal Of Clinical Nursing, 20(11/12), 1606-1612. doi:10.1111/j.1365-2702.2010.03551.x

Sugiyama, S., Okuda, M., Sasaki, S., Kunitsugu, I., & Hobara, T. (2012). Breakfast habits among adolescents and their association with daily energy and fish, vegetable, and fruit intake: a community-based cross-sectional study. *Environmental health and preventive medicine*, *17*(5).

Swan, E., Bouwman, L., Aarts, N., Rosen, L., Hiddink, G. J., & Koelen, M. (2018). Food stories: Unraveling the mechanisms underlying healthful eating. Appetite, 120456-463. doi:10.1016/j.appet.2017.10.005

Tassitano, R. M., Martins, C. M. D. L., Cabral, P. C., Mota, J., Tenorio, M. C. M., & Silva, G. A. P. D. (2016). Psychosocial factors and physical activity as predictors of fruit and vegetable intake in college students. *Revista de Nutrição*, *29*(2), 173-183.

Teschl, C., Nössler, C., Schneider, M., Carlsohn, A., & Lührmann, P. (2018). Vegetable consumption among university students: Relationship between vegetable intake, knowledge of recommended vegetable servings and self-assessed achievement of vegetable intake recommendations. *Health Education Journal*, 0017896917751833.

Thompson, D., Bhatt, R., Vazquez, I., Cullen, K. W., Baranowski, J., Baranowski, T., & Yan, L. (2015). Creating action plans in a serious video game increases and maintains child fruit-vegetable intake: a randomized controlled trial. International Journal Of Behavioral Nutrition & Physical Activity, 121-10. doi:10.1186/s12966-015-0199-z

Tiedje, K., Wieland, M. L., Meiers, S. J., Mohamed, A. A., Formea, C. M., Ridgeway, J. L., ... & Patten, C. A. (2014). A focus group study of healthy eating knowledge,

practices, and barriers among adult and adolescent immigrants and refugees in the United States. *International Journal of Behavioral Nutrition and Physical Activity*, *11*(1), 63.

Totan, T. t. (2014). Distinctive Characteristics of Flourishing, Self-Esteem, and Emotional Approach Coping to Mood. International Online Journal Of Educational Sciences, 6(1), 30-40. doi:10.15345/iojes.2014.01.004

Trudeau, E., Kristal, A. R., Li, S., & Patterson, R. E. (1998). Demographic and psychosocial predictors of fruit and vegetable intakes differ: implications for dietary interventions. Journal Of The American Dietetic Association, 98(12), 1412-1417.

Ungar, N., Sieverding, M., & Stadnitski, T. (2013). Increasing fruit and vegetable intake.“Five a day” versus “just one more”. *Appetite*, *65*, 200-204.

Ungar, N., Sieverding, M., Schweizer, F., & Stadnitski, T. (2015). Intervention-elicited reactance and its implications: Let me eat what I want. *Zeitschrift für Psychologie*, *223*(4), 247.

Utter, J., Larson, N., Laska, M. N., Winkler, M., & Neumark-Sztainer, D. (2018). Self-Perceived Cooking Skills in Emerging Adulthood Predict Better Dietary Behaviors and Intake 10 Years Later: A Longitudinal Study. *Journal of nutrition education and behavior*, *50*(5), 494-500.

Van Koningsbruggen, G. M., Harris, P. R., Smits, A. J., Schüz, B., Scholz, U., & Cooke, R. (2016). Self-affirmation before exposure to health communications promotes intentions and health behavior change by increasing anticipated regret. Communication Research, 43(8), 1027-1044. doi:10.1177/0093650214555180

Van ’t Riet, J., Werrij, M. Q., Nieuwkamp, R., de Vries, H., & Ruiter, R. A. (2013). Short Communication: Message frame and self-efficacy influence the persuasiveness of nutrition information in a fast-food restaurant. Food Quality And Preference, 291-5. doi:10.1016/j.foodqual.2013.01.007

Videon, T. M., & Manning, C. K. (2003). Influences on adolescent eating patterns: the importance of family meals. *Journal of adolescent health*, *32*(5), 365-373.

Vincent, M. A., & McCabe, M. P. (2000). Gender differences among adolescents in family, and peer influences on body dissatisfaction, weight loss, and binge eating behaviors. *Journal of youth and Adolescence*, *29*(2), 205-221.

Walton, K. L. (1990). Mimesis as make-believe : on the foundations of the representational arts / Kendall L. Walton. Cambridge, Mass. : Harvard University Press, 1990.

Wang, X., Ouyang, Y., Liu, J., Zhu, M., Zhao, G., Bao, W., & Hu, F. B. (2014). Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: systematic review and dose-response meta-analysis of prospective cohort studies. Doi:10.1136/Bmj.G4490, doi:10.1136/bmj.g4490

Ward, K., & Hawthorne, K. (1994). Do patients read health promotion posters in the waiting room? A study in one general practice. *Br J Gen Pract*, *44*(389), 583-585.

White, B. A., Horwath, C. C., & Conner, T. S. (2013). Many apples a day keep the blues away--daily experiences of negative and positive affect and food consumption in young adults. British Journal Of Health Psychology, 18(4), 782-798. doi:10.1111/bjhp.12021

Williams-Piehota, P., Pizarro, J., Silvera, S., Mowad, L., & Salovey, P. (2006). Need for cognition and message complexity in motivating fruit and vegetable intake among callers to the Cancer Information Service. Health Communication, 19(1), 75-84.

Winston, J., Johnson, C., & Wilson, S. (2008). Barriers to healthy eating by National Health Service (NHS) hospital doctors in the hospital setting: results of a cross-sectional survey. *BMC research notes*, *1*(1), 69.

Wolf RL, Lepore SJ, Vandergrift JL, Wetmore-Arkader L, McGinty E, Pietrzak G, Yaroch AL. Knowledge, barriers, and stage of change as correlates of fruit and vegetable consumption among urban and mostly immigrant black men. J Am Diet Assoc. 2008;108:1315-22. doi: 10.1016/j.jada. 2008.05.011.

Woolford, S. J., Barr, K. L., Derry, H. A., Jepson, C. M., Clark, S. J., Strecher, V. J., & Resnicow, K. (2011). OMG do not say LOL: obese adolescents' perspectives on the content of text messages to enhance weight loss efforts. *Obesity*, *19*(12), 2382-2387

Zajonc, R. B. (1968). Attitudinal effects of mere exposure. *Journal of personality and social psychology*, *9*(2p2), 1.

Zandstra, E. H., Carvalho, Á. H., & van Herpen, E. (2017). Effects of front-of-pack social norm messages on food choice and liking. Food Quality And Preference, 5885-93. doi:10.1016/j.foodqual.2017.01.007

Zhang, R. (2016). Positive Affect and Self-Efficacy as Mediators Between Personality and Life Satisfaction in Chinese College Freshmen. Journal Of Happiness Studies, 17(5), 2007-2021. doi:10.1007/s10902-015-9682-0

Appendices

Appendix 1: Study 1 posters


Eat 5 fruit and vegetables today
and improve your future
heart health


Eat 5 fruit and vegetables today
and improve your current
heart health

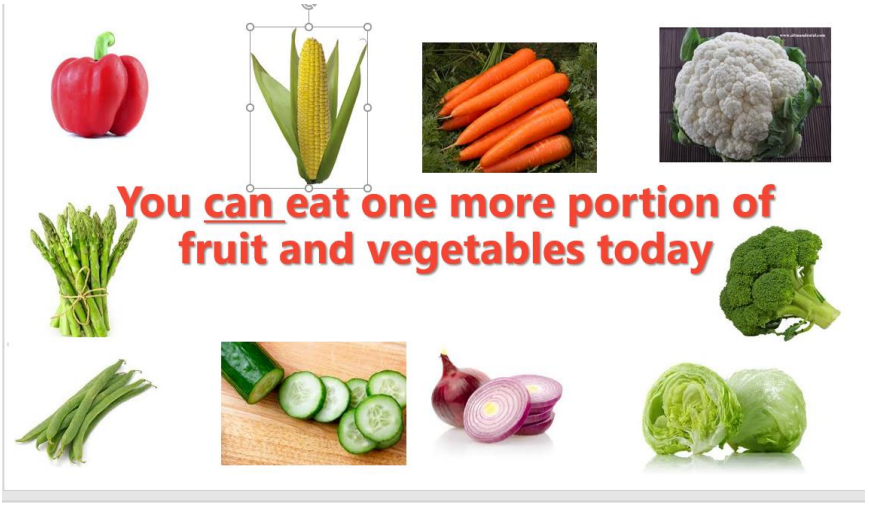

Eat 1 extra fruit or vegetable
today and improve your future
body weight


Eat 1 extra fruit or vegetable
today and improve your current
body weight


Eat 5 fruit and vegetables today
and improve your future
body weight

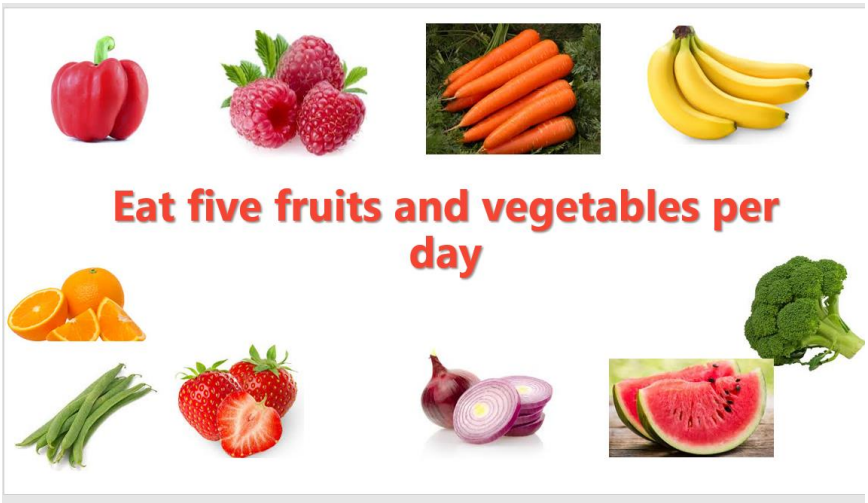

Eat 5 fruit and vegetables today
and improve your current
body weight

Appendix 2: Study 2 posters in varying designs (with varying images of fruits, vegetables and fruits and vegetables




You can look after your body weight by eating fruits and vegetables


You can enjoy fruits and vegetables


Eat five fruits and vegetables per day

Appendix 3: The positive and negative affect schedule – Expanded form (Watson & Clark, 1999) (PANAS-X)

PANAS-X

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you have felt this way during the past week. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

_____ cheerful	_____ sad	_____ active	_____ angry at self
_____ disgusted	_____ calm	_____ guilty	_____ enthusiastic
_____ attentive	_____ afraid	_____ joyful	_____ downhearted
_____ bashful	_____ tired	_____ nervous	_____ sheepish
_____ sluggish	_____ amazed	_____ lonely	_____ distressed
_____ daring	_____ shaky	_____ sleepy	_____ blameworthy
_____ surprised	_____ happy	_____ excited	_____ determined

_____ strong	_____ timid	_____ hostile	_____ frightened
_____ scornful	_____ alone	_____ proud	_____ astonished
_____ relaxed	_____ alert	_____ jittery	_____ interested
_____ irritable	_____ upset	_____ lively	_____ loathing
_____ delighted	_____ angry	_____ ashamed	_____ confident
_____ inspired	_____ bold	_____ at ease	_____ energetic
_____ fearless	_____ blue	_____ scared	_____ concentrating
_____ disgusted with self	_____ shy	_____ drowsy	_____ dissatisfied with self

Appendix 4: Food diary

Please complete this food diary on Sunday, Monday and Tuesday with the food and drinks you consume. There are sections for "Breakfast", "Pre-Lunch", "Lunch", Pre-Dinner", "Dinner" and "After Dinner".

If you do not eat or drink anything during one of these times e.g. after dinner" please indicate this using "N/A".

Please also specify the amount of each item consumed e.g. weight/ household measures (100g, 1 teaspoon).

Please also include where you were eating/ drinking e.g. at home, a restaurant.

If there are any particular reasons for your food choices (e.g. mood) that you would like to mention, please do not hesitate to include them.

At the end of each day please also complete the enclosed mood questionnaire.

If you have any questions about the instructions please contact me on zborgonha@bournemouth.ac.uk

Sunday

Breakfast

Pre-lunch

Lunch

Pre-dinner

Dinner

Appendix 5: Multiple linear regression assumptions

Multiple linear regression assumptions

Model 1

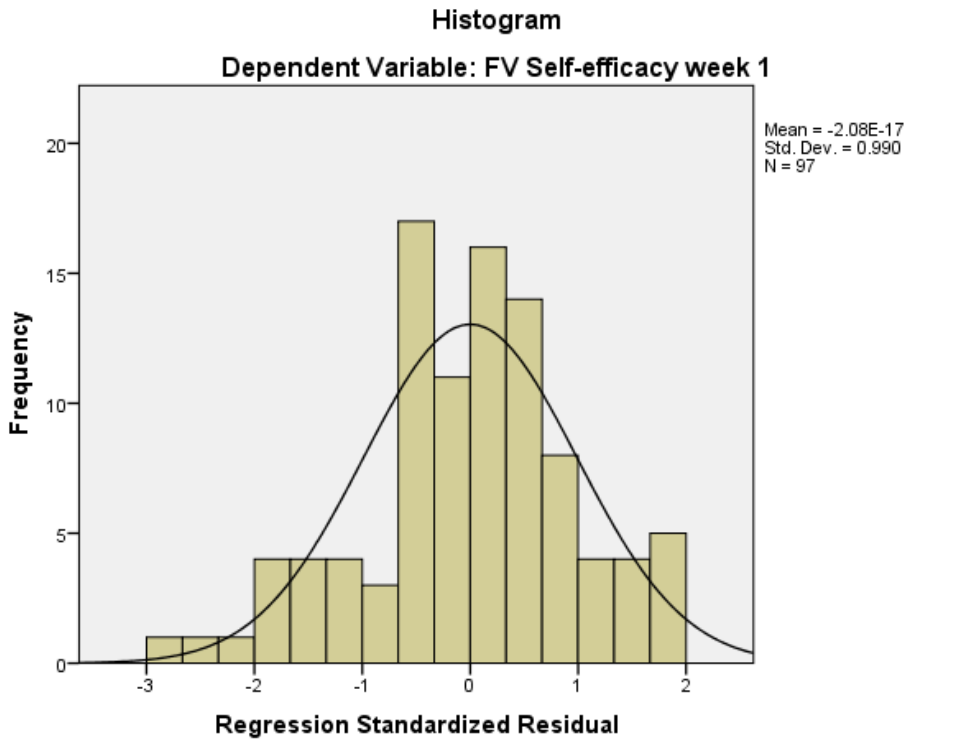
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

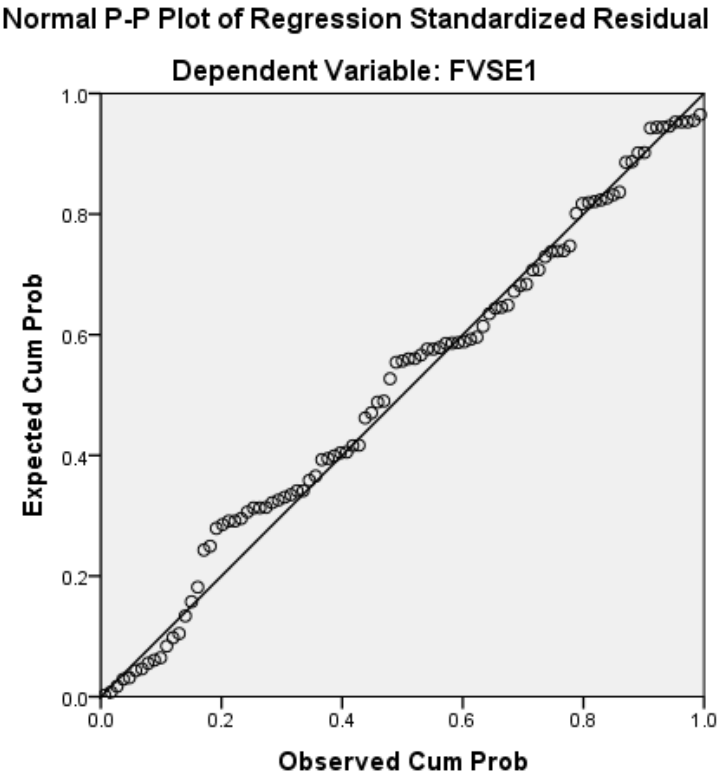
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line but close. Overall normality is reasonable.

Figure 1: Histogram of standardized residuals for Model 1.



Dependent variable = FV self-efficacy before poster viewing. Independent variables = negative affect before poster viewing and positive affect before poster viewing

Figure 2: P-P plot of standardized residuals for Model 1



Dependent variable=FV self-efficacy before poster viewing. Independent variables = negative affect before poster viewing and positive affect before poster viewing.

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 3 (Std. Residual min=-2.112, Std. Residual max = -2.822). This is not ideal but is acceptable.

No or little multicollinearity has been achieved

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (Mean general negative affect 1, Tolerance = .989, VIF= 1.012; mean general positive affect 1, Tolerance =.989, VIF = 1.012).

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 1.714).

Correlation

Reasonable correlations were observed between all variables (min *r*= -.107, max= .077).

Model 2

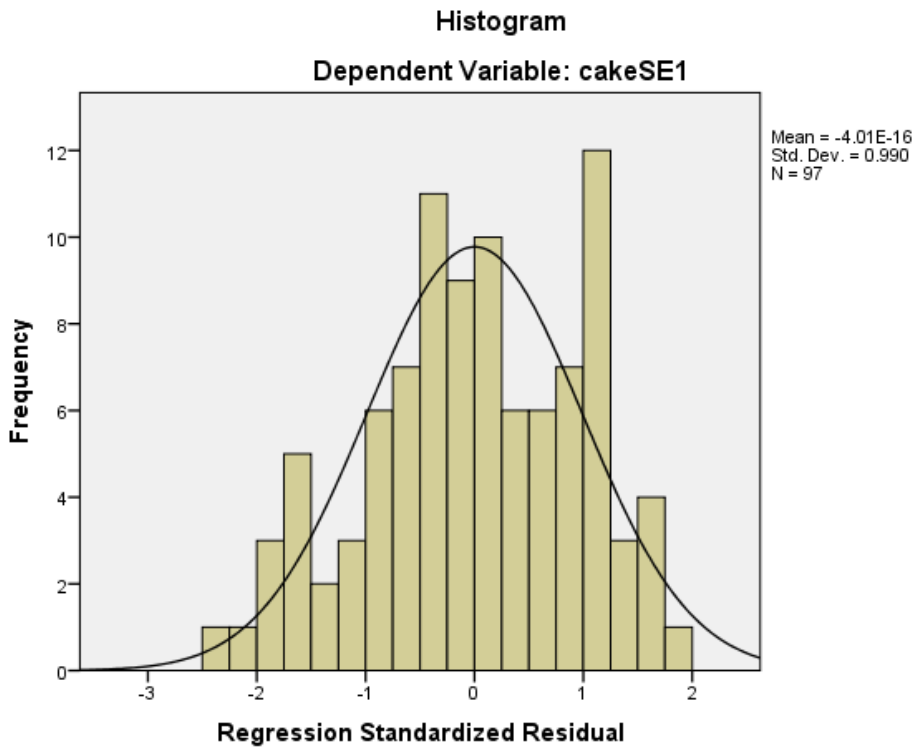
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

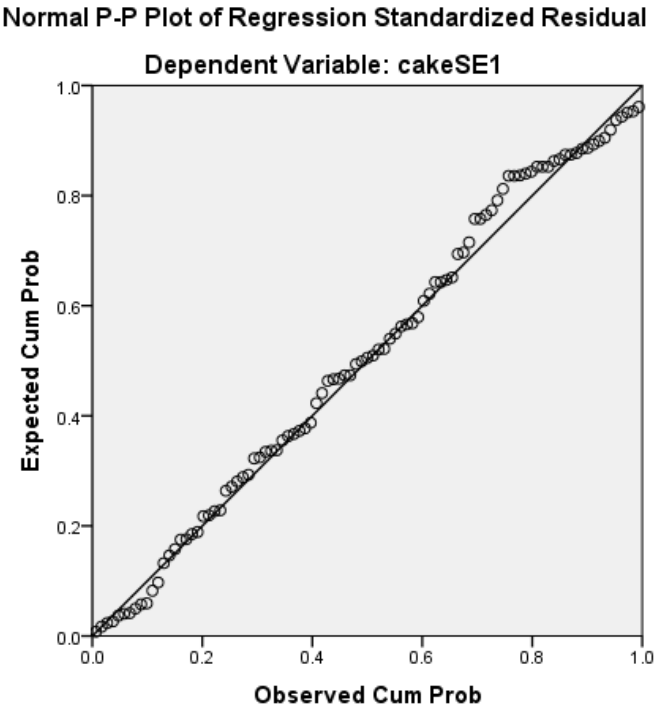
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 3: Histogram of standardized residuals for Model 2.



Dependent variable = Self-efficacy for cake bars before poster viewing. Independent variables = negative affect before poster viewing and positive affect before poster viewing

Figure 4: P-P plot of standardized residuals for Model 2



Dependent variable = Self-efficacy for cake bars before poster viewing. Independent variables = negative affect before poster viewing and positive affect before poster viewing

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 2 (Std. Residual min = -2.122, Std residual max = -2.416).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (Mean general negative affect 1, Tolerance = .989, VIF= 1.012; mean general positive affect 1, Tolerance =.989, VIF = 1.012).

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 2.053).

Correlations

Reasonable correlations were observed between variables (max *r*= .262, min *r*= -.167.)

Model 3

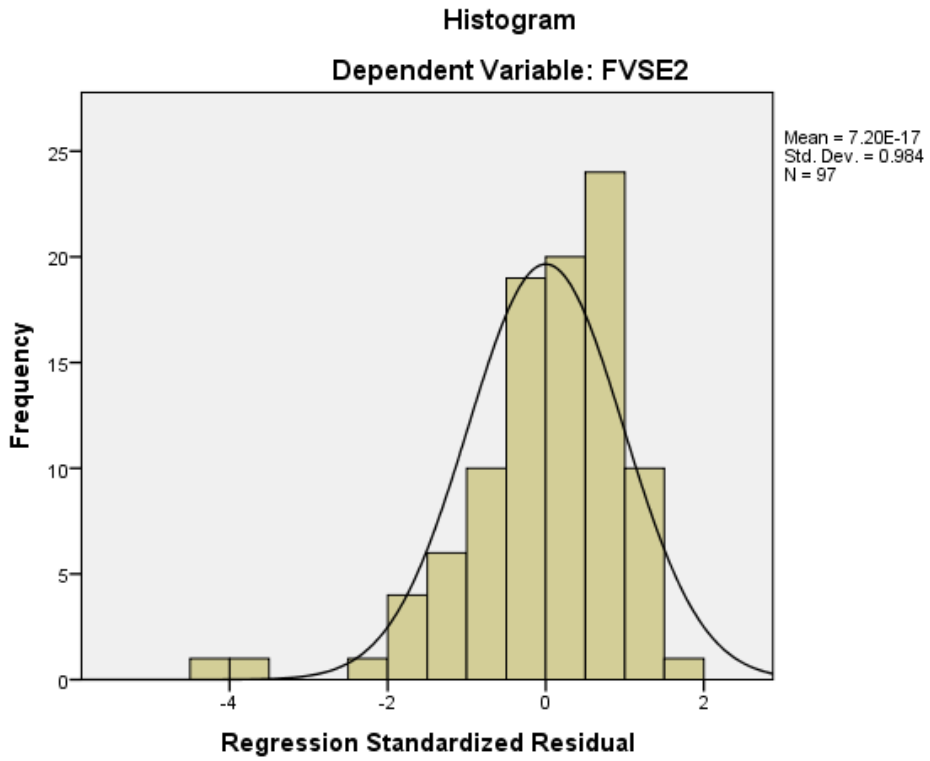
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

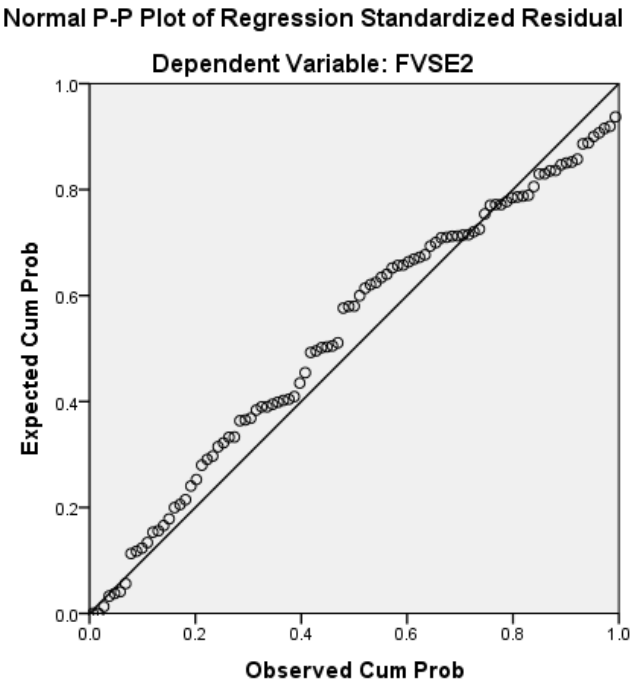
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 5: Histogram of standardized residuals for Model 3



Dependent variable = FV self-efficacy after poster viewing. Independent variables = negative affect after poster viewing, positive affect after poster viewing and poster message condition.

Figure 6: P-P plot of standardized residuals for Model 3.



Dependent variable = FV self-efficacy after poster viewing. Independent variables = negative affect after poster viewing, positive affect after poster viewing and poster message condition.

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 3 (Std. residual min = -2.230, Std. residual max = -4.112).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (Mean general negative affect 2, Tolerance = .975, VIF= 1.025; mean general positive affect 2, Tolerance =.929, VIF = 1.077; poster group, Tolerance = .949, VIF = 1.054).

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 2.165).

Correlations

Reasonable correlations were observed between variables (min *r*= -.020, max *r*= .220).

Model 4

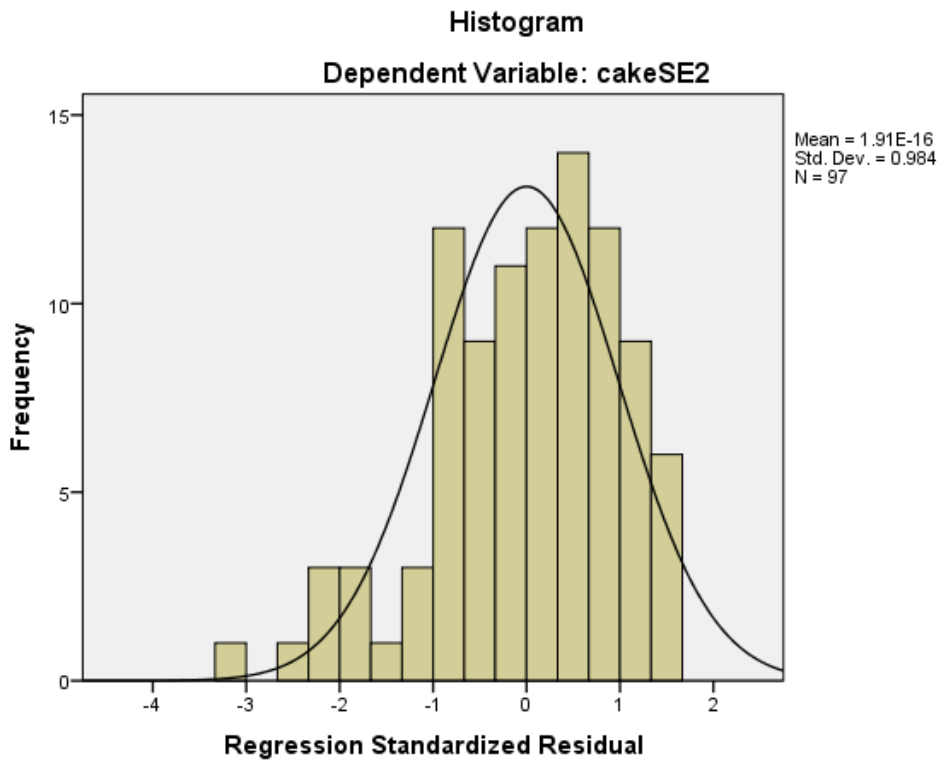
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

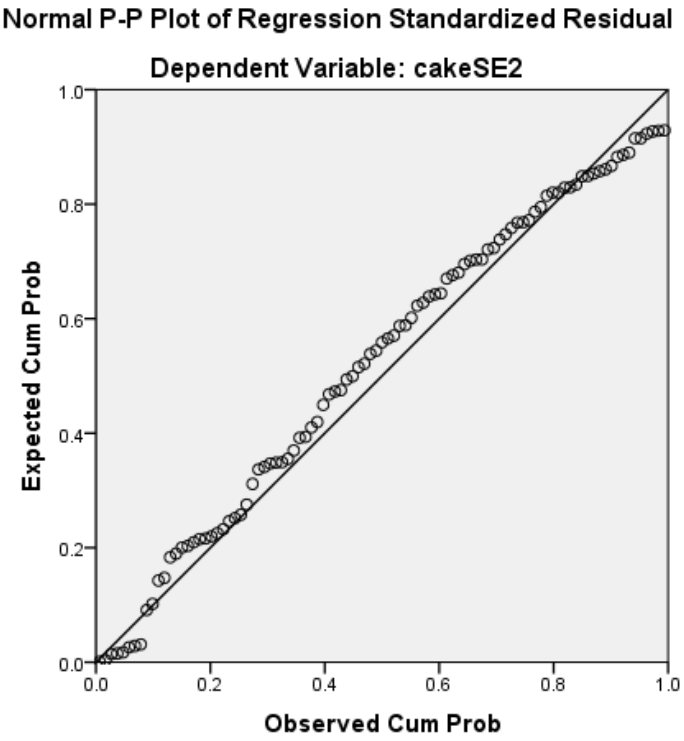
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 7: Histogram of standardized residuals for Model 4



Dependent variable = self-efficacy for cake bars after poster viewing. Independent variables = negative affect after poster viewing, positive affect after postr viewing and poster message condition.

Figure 8: P-P plot of standardized residuals for Model 4



Dependent variable = self-efficacy for cake bars after poster viewing. Independent variables = negative affect after poster viewing, positive affect after postr viewing and poster message condition.

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 5 (Std residual min = -2.113, Std residual max = -3.076)

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (Mean general negative affect 2, Tolerance = .975, VIF= 1.025; mean general positive affect 2, Tolerance =.929, VIF = 1.077; poster group, Tolerance = .949, VIF = 1.054).

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 1.686).

Correlations

Reasonable correlations were observed between variables (min *r* = -.040, max *r*=.220)

Model 5

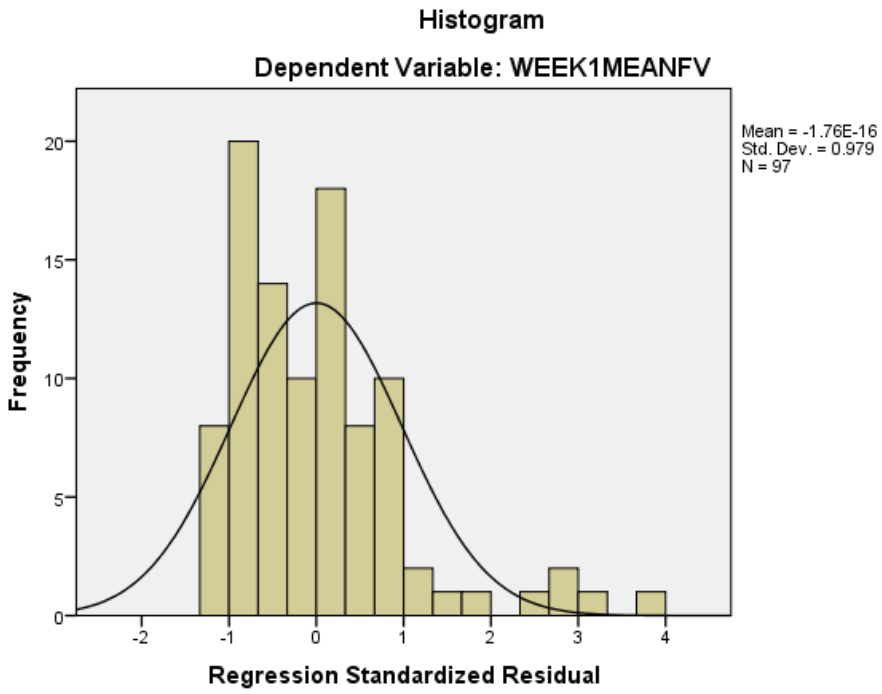
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

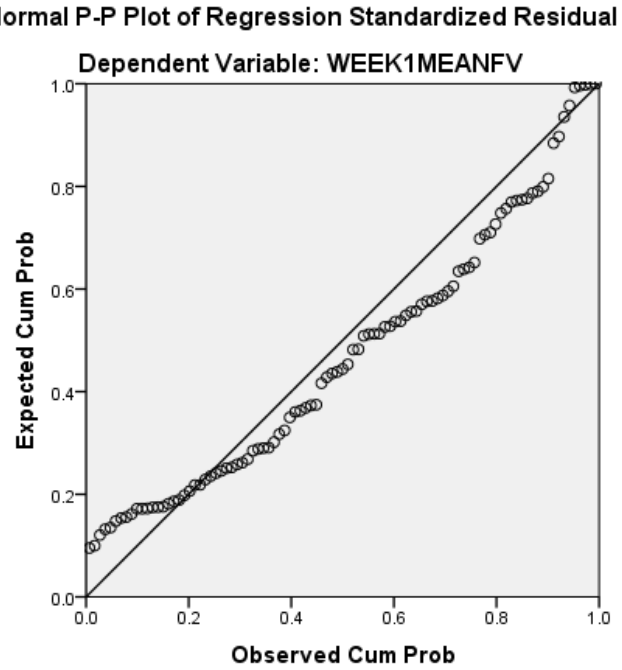
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 9: Histogram of standardized residuals for Model 5.



Dependent variable = Mean total FV intake before poster viewing. Independent variables = self-efficacy for FV before poster viewing, negative affect before poster viewing, positive affect before poster viewing, normal FV consumption and liking for FV

Figure 10: P-P plot of standardized residuals for Model 5



Dependent variable = Mean total FV intake before poster viewing. Independent variables = self-efficacy for FV before poster viewing, negative affect before poster viewing, positive affect before poster viewing, normal FV consumption and liking for FV

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 5 (Std residual min = 2.453, Std residual max = 3.880).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (FV self-efficacy 1, Tolerance = .697, VIF = 1.435; Mean general negative affect 1, Tolerance= .910, VIF = 1.098, mean general positive affect 1, Tolerance = .848, VIF = 1.180; Normal FV consumption, Tolerance = .733, VIF = 1.364; FV liking, Tolerance= .612, VIF = 1.633)

No auto correlation

The data met the assumption of independent errors (Durbin-Watson= 2.017).

Correlations

Reasonable correlations were observed between variables (min r = -.203, max r=.462).

Model 6

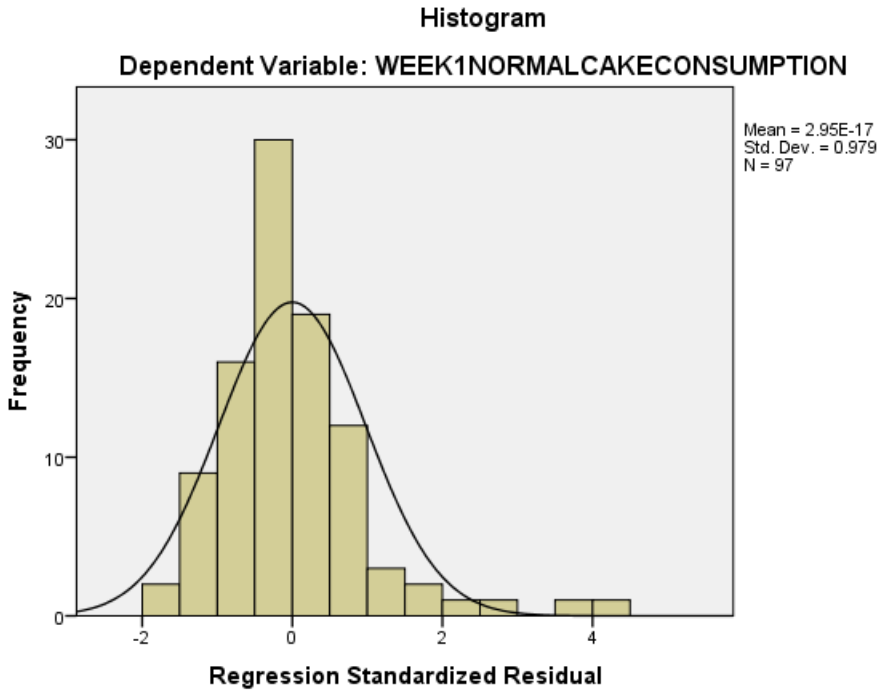
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

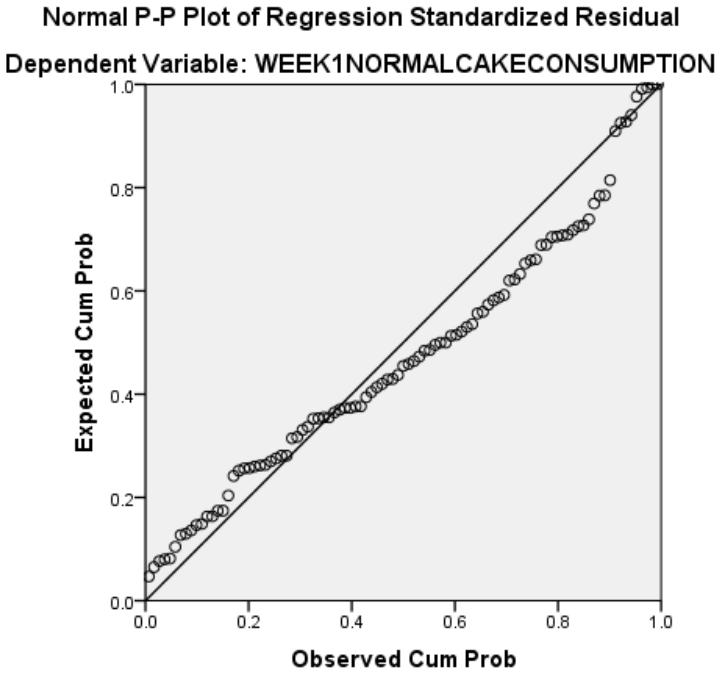
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 11: Histogram of standardized residuals for Model 6



Dependent variable = normal cake bar consumption. Independent variables = self-efficacy for cake bars before poster viewing, negative affect before poster viewing, positive affect before poster viewing and liking for cake bars measured before poster viewing

Figure 12: P-P plot of standardized residuals for Model 6.



Dependent variable = normal cake bar consumption. Independent variables = self-efficacy for cake bars before poster viewing, negative affect before poster viewing, positive affect before poster viewing and liking for cake bars measured before poster viewing

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 4 (Std residual min = 2.370, Std residual max = 4.138).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (Cake self-efficacy 1, Tolerance = .858, VIF = 1.165; Mean general negative affect 1, Tolerance= .966, VIF = 1.036, mean general positive affect 1, Tolerance = .912, VIF = 1.096; Cake liking, Tolerance= .899, VIF = 1.113)

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 2.077).

Correlations

Reasonable correlations were observed between variables (min *r* = -.152, max *r*=.289).

Model 7

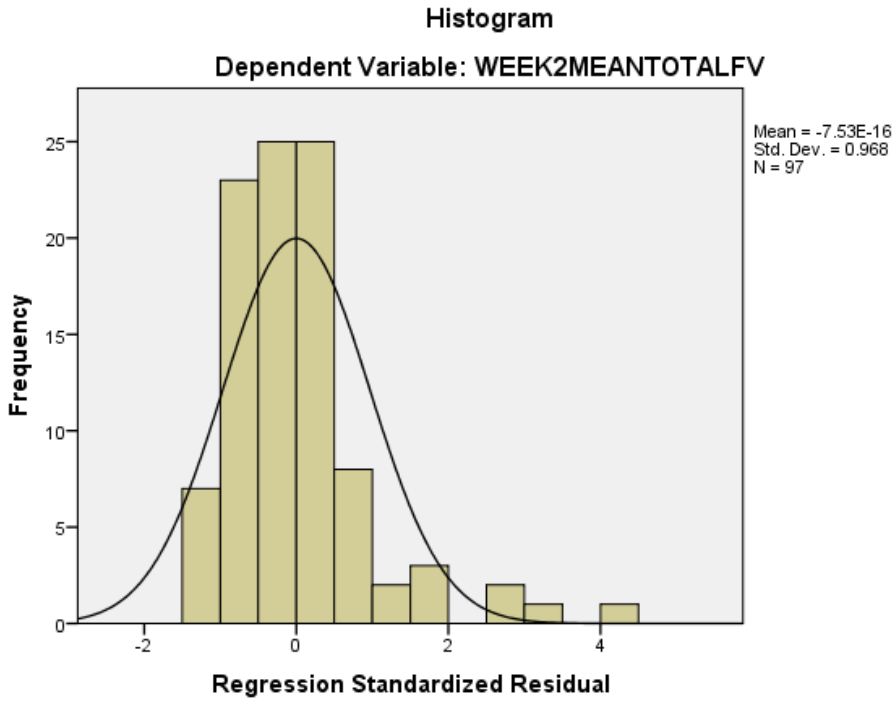
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

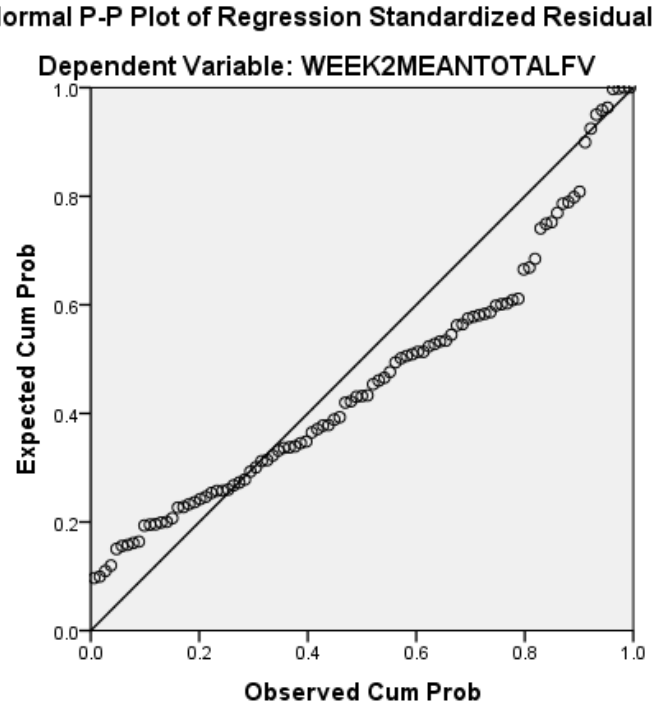
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 13: Histogram of standardized residuals for Model 7



Dependent variable = mean FV intake after poster viewing. Independent variables = self-efficacy for FV after poster viewing, negative affect after poster viewing, positive affect after poster viewing, intentions to eat FV after poster viewing and poster message condition

Figure 14: P-P plot of standardized residuals for Model 7



Dependent variable = mean FV intake after poster viewing. Independent variables = self-efficacy for FV after poster viewing, negative affect after poster viewing, positive affect after poster viewing, intentions to eat FV after poster viewing and poster message condition

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 4 (Std residual min = 2.778, Std residual max = 4.294).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (FV self-efficacy 2, Tolerance = .752, VIF = 1.330; Mean general negative affect 2, Tolerance= .956, VIF = 1.046, mean general positive affect 2 , Tolerance = .836, VIF = 1.196; FV liking 2, Tolerance =.646, VIF = 1.547; poster group, Tolerance = .888, VIF = 1.126; FV intentions, Tolerance= .639, VIF = 1.565).

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 2.169).

Correlations

Reasonable correlations were observed between variables (min r = -.249, max r = .515)

Model 8

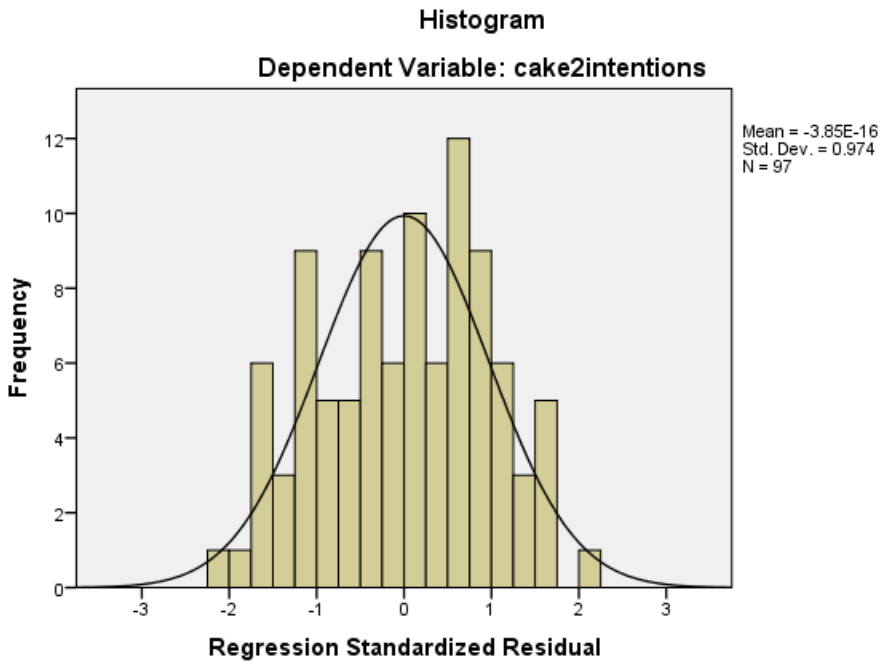
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

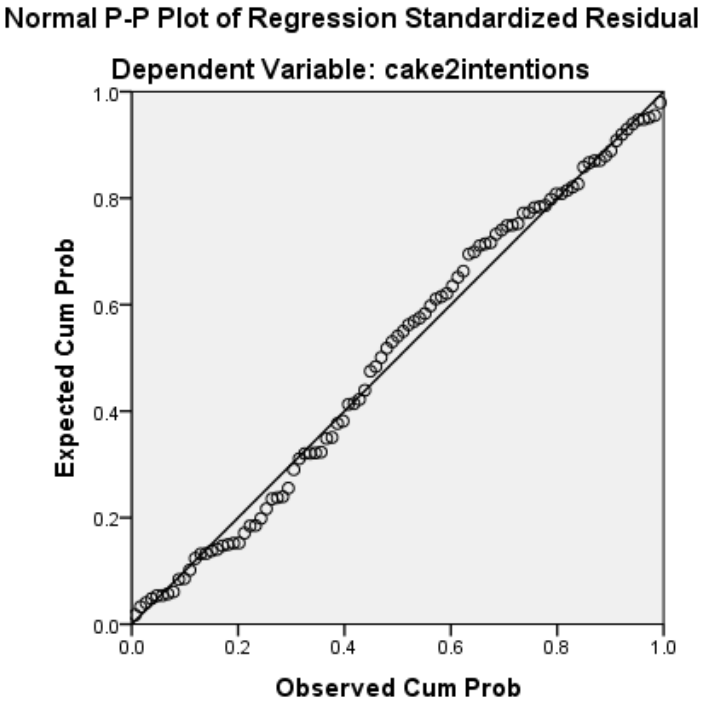
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 15: Histogram of standardized residuals for Model 6



Dependent variable = intentions to eat cake bars measured after poster viewing. Independent variables = self-efficacy for cake bars measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, liking for cake bars measured after poster viewing and poster message condition

Figure 16: P-P plot of standardized residuals for Model 8.



Dependent variable = intentions to eat cake bars measured after poster viewing. Independent variables = self-efficacy for cake bars measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, liking for cake bars measured after poster viewing and poster message condition

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 2 (Std residual min = -2.113, Std residual max = 2.042).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (Cake self-efficacy 2, Tolerance = .968, VIF = 1.033; Mean general negative affect 2, Tolerance= .972, VIF = 1.028, mean general positive affect 2 , Tolerance = .908, VIF = 1.102; Cake liking 2, Tolerance =.955, VIF = 1.047; poster group, Tolerance = .940, VIF = 1.064).

No auto-correlation.

The data met the assumption of independent errors (Durbin-Watson= 2.019).

Correlations

Reasonable correlations were observed between variables (min r =-.233, max r= .095).

Model 9

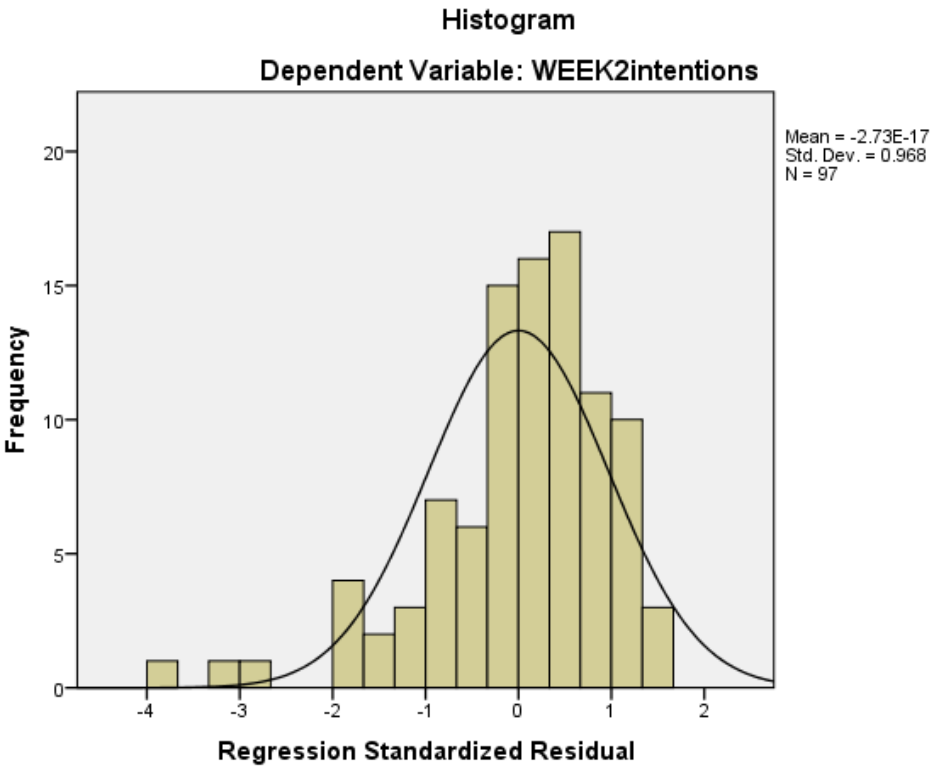
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

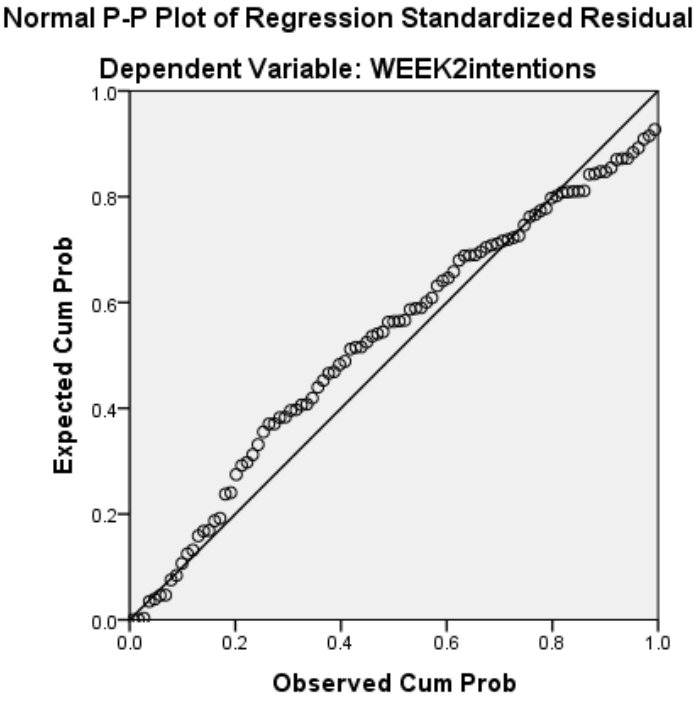
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 17: Histogram of standardized residuals for Model 9



Dependent variable = intentions to eat FV measured after poster viewing. Independent variables = self-efficacy for FV measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, FV intake measured after poster viewing, liking for FV measured after poster viewing and poster message condition

Figure 18: P-P plot of standardized residuals for Model 9



Dependent variable = intentions to eat FV measured after poster viewing. Independent variables = self-efficacy for FV measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, FV intake measured after poster viewing, liking for FV measured after poster viewing and poster message condition

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 3 (Std residual min =-2.734, Std residual max = -3.722).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (FV self-efficacy 2, Tolerance = .843, VIF = 1.187; mean general negative affect, Tolerance = .939, VIF = 1.065, mean general positive affect, Tolerance = .812, VIF = 1.232; FV intake 2, Tolerance = .915, VIF = 1.093; Poster group, Tolerance = .872, VIF = 1.146; FV liking 2, Tolerance = .798, VIF = 1.254).

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 1.895).

Correlations

Reasonable correlations were observed between all variables (min r = -.249, max r = .515).

Model 10

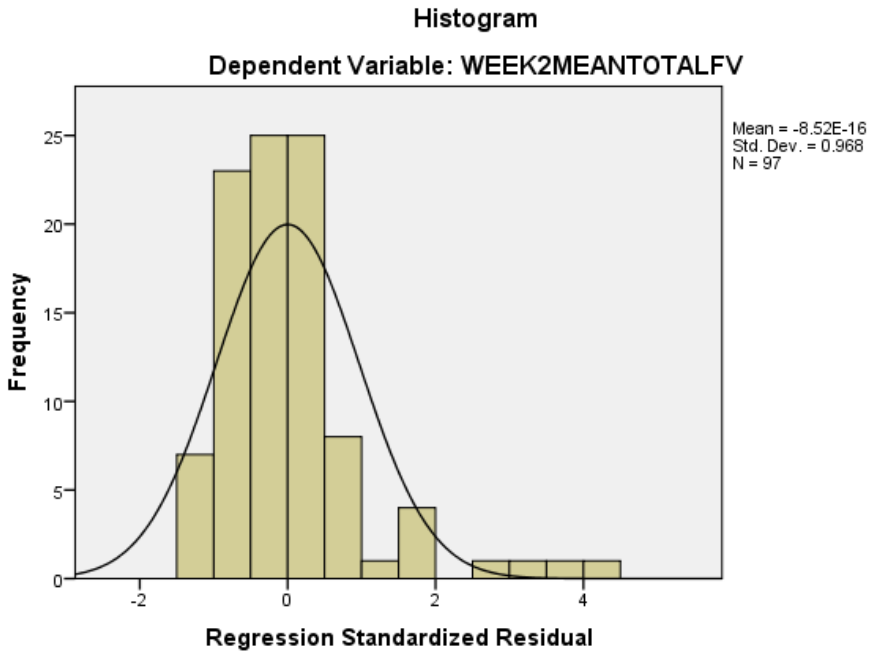
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

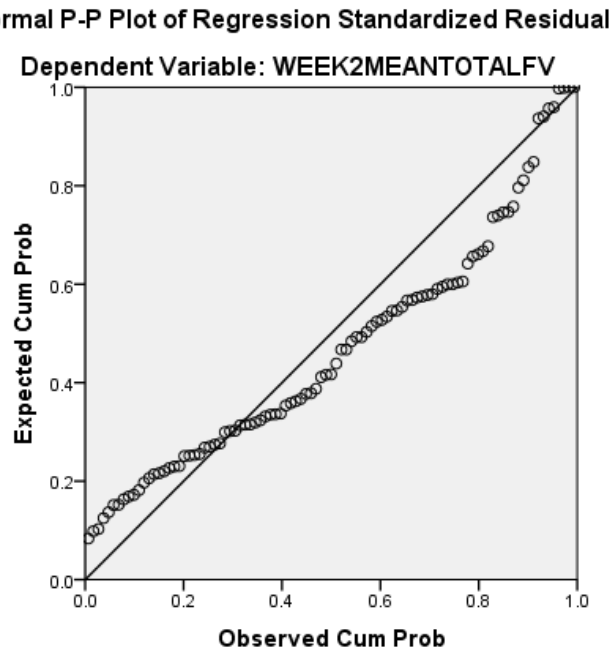
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 19: Histogram of standardized residuals for Model 10



Dependent variable = mean FV intake measured after poster viewing. Independent variables = self-efficacy for FV measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, liking for FV measured after poster viewing, intentions to eat FV measured after poster viewing and poster message condition (intervention vs control)

Figure 20: P-P plot of standardized residuals for Model 10



Dependent variable = mean FV intake measured after poster viewing. Independent variables = self-efficacy for FV measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, liking for FV measured after poster viewing, intentions to eat FV measured after poster viewing and poster message condition (intervention vs control)

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 3 (Std residual min = 3.019, Std residual max = 4.211).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem. (FV self-efficacy 2, Tolerance =.755, VIF = 1.325; mean general negative affect, Tolerance = .955, VIF = 1.047; mean general positive affect, Tolerance = .809, VIF = 1.236; FV liking, Tolerance = .688, VIF = 1.454; FV intentions, Tolerance = .631, VIF = 1.586; poster condition (I vs C), Tolerance = .895, VIF = 1.118.

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 2.156).

Correlations

Reasonable correlations were observed between variables (min r =-.218, max r = .515).

Model 11

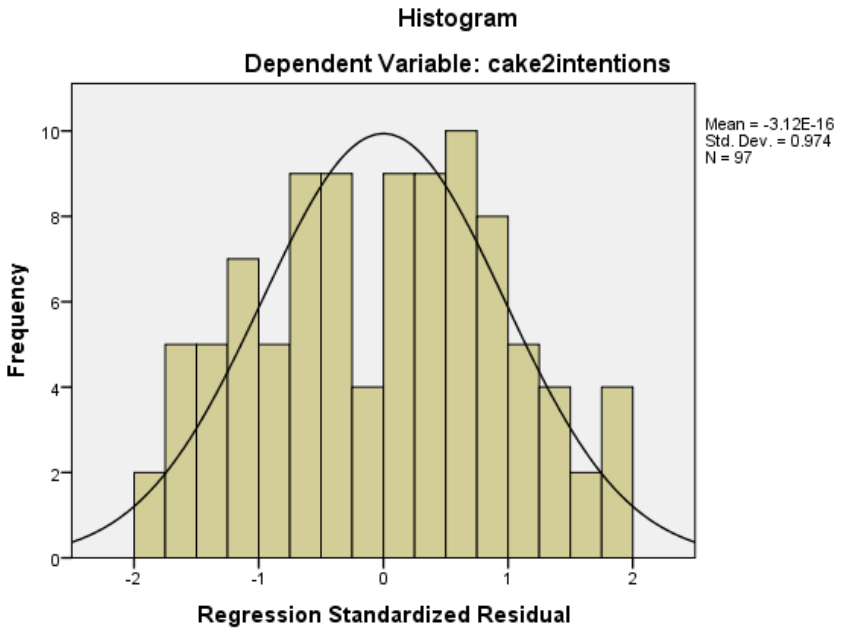
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

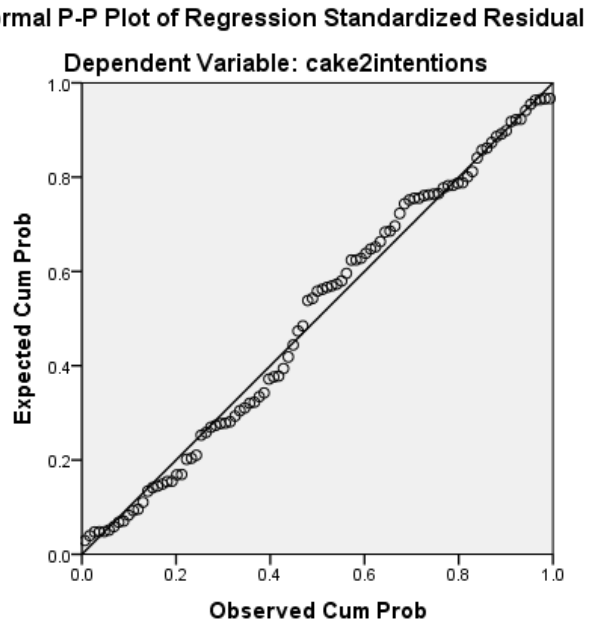
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 21: Histogram of standardized residuals for Model 11



Dependent variable = intentions to eat cake bars measured after poster viewing. Independent variables = self-efficacy for cake bars measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, liking for cake bars measured after poster viewing and poster message condition (intervention vs control).

Figure 22: P-P plot of standardized residuals for Model 11.



Dependent variable = intentions to eat cake bars measured after poster viewing. Independent variables = self-efficacy for cake bars measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, liking for cake bars measured after poster viewing and poster message condition (intervention vs control).

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 0.

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem (cake bar self-efficacy, Tolerance = .946, VIF = 1.057; mean general negative affect, Tolerance = .975, VIF = 1.026; mean general positive affect, Tolerance = .908, VIF = 1.101; cake bar liking, Tolerance = .958, VIF = 1.044; poster condition (I vs C), Tolerance = .919, VIF = 1.088.

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 1.992).

Correlations

Reasonable correlations were observed between variables (min r = -.040, max r = .308).

Model 12

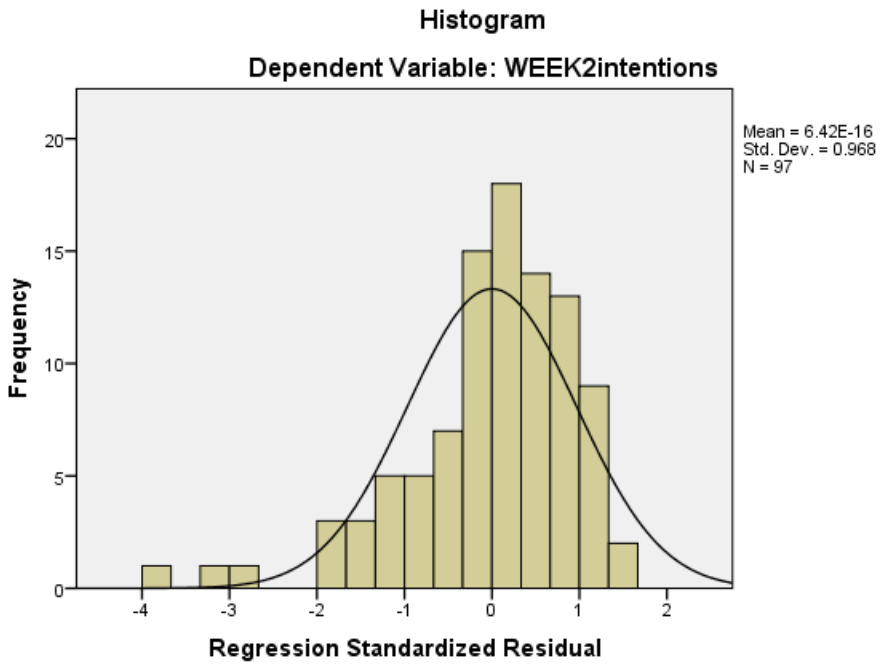
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

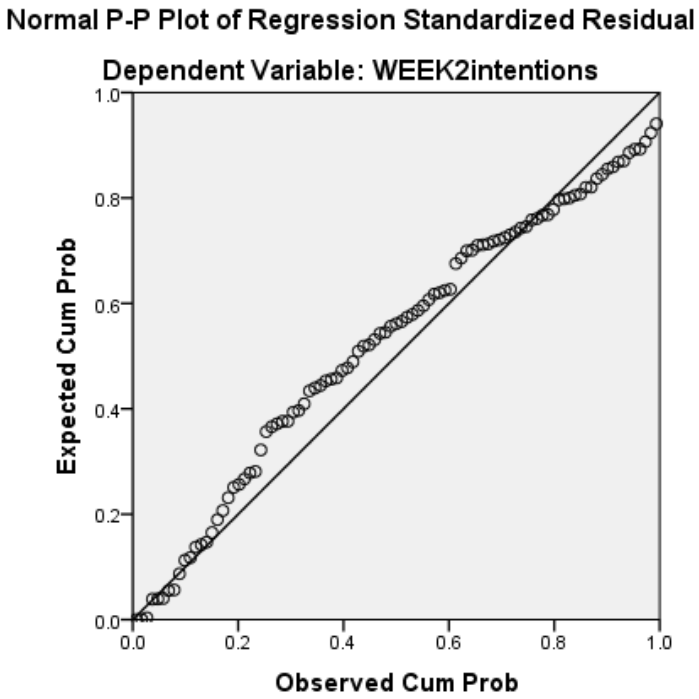
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 23: Histogram of standardized residuals for Model 12



Dependent variable = intentions to eat FV measured after poster viewing. Independent variables = self-efficacy for FV measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, FV intake measured after poster viewing, liking for FV measured after poster viewing and poster message condition (intervention vs control)

Figure 24: P-P plot of standardized residuals for Model 12



Dependent variable = intentions to eat FV measured after poster viewing. Independent variables = self-efficacy for FV measured after poster viewing, negative affect measured after poster viewing, positive affect measured after poster viewing, FV intake measured after poster viewing, liking for FV measured after poster viewing and poster message condition (intervention vs control)

Ratio of cases to predictors

The sample of 97 in the present study was large enough according Tabachnick & Fidell (2007). An analysis of standard residuals was carried out on the data to identify any outliers, which indicated that there were 3 (Std residual min =-2.669, Std residual max = -3.667).

Multicollinearity

Tests to see if the data met the multicollinearity assumptions indicated that this was not a problem (FV self-efficacy, Tolerance = .845, VIF = 1.184; mean general negative affect, Tolerance = .939, VIF = 1.065; mean general positive affect, Tolerance = .787, VIF = 1.271; FV intake 2, Tolerance = .925, VIF = 1.081; FV liking, Tolerance = .826, VIF = 1.210; poster condition (I vs C), Tolerance = .900, VIF = 1.111)

No auto-correlation

The data met the assumption of independent errors (Durbin-Watson= 1.935).

Correlations

Reasonable correlations were observed between variables (min r = -.281, max r= .322)

Model 13

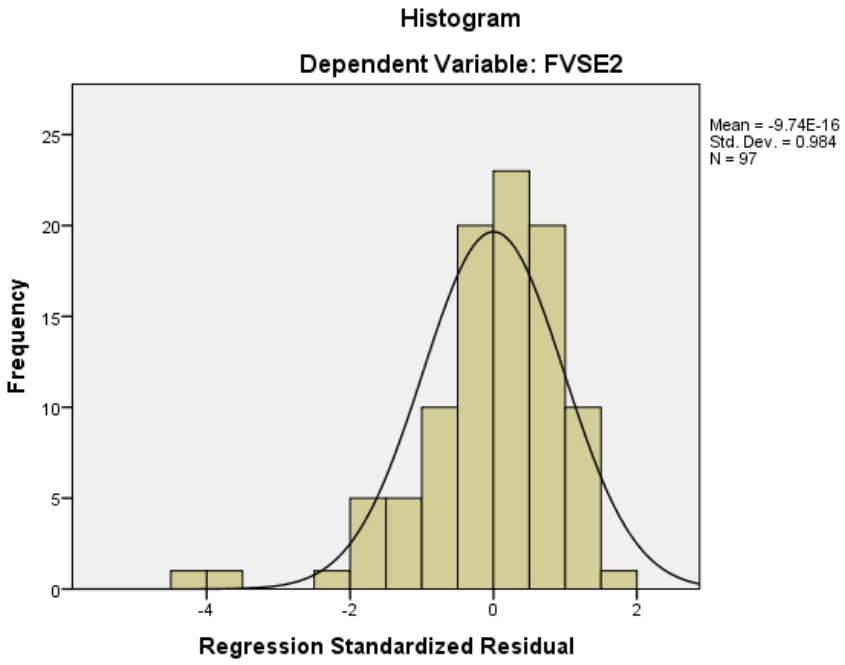
Linearity

Examination of scatter plots for each dependent and independent variable suggest the assumption of linearity has been violated. Therefore, results must be treated with caution.

Normally distributed outcome variable and errors/residuals

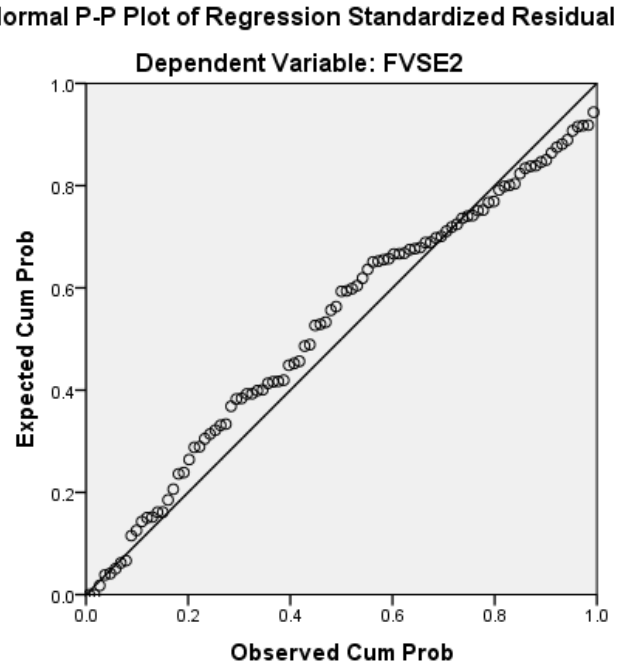
The histogram of standardized residuals indicated that the data did contain normally distributed errors, as did the P-P plot of standardized residuals which showed that data points were not completely on the line. Overall normality is reasonable.

Figure 25: Histogram of standardized residuals for Model 13



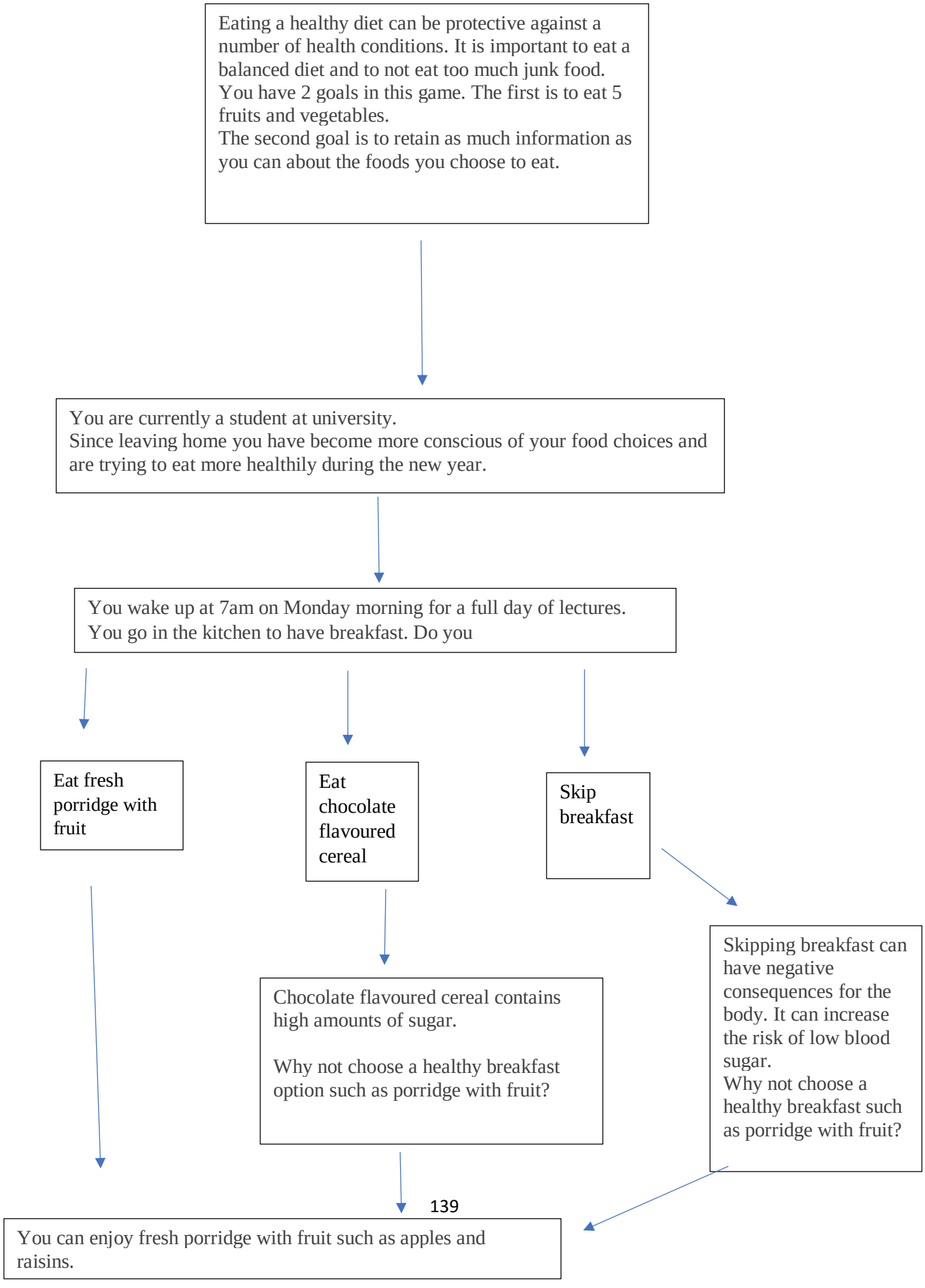
Dependent variable = self-efficacy for FV measured after poster viewing. Independent variables = negative affect measured after poster viewing, positive affect measured after poster viewing and poster message condition (interntion vs control)

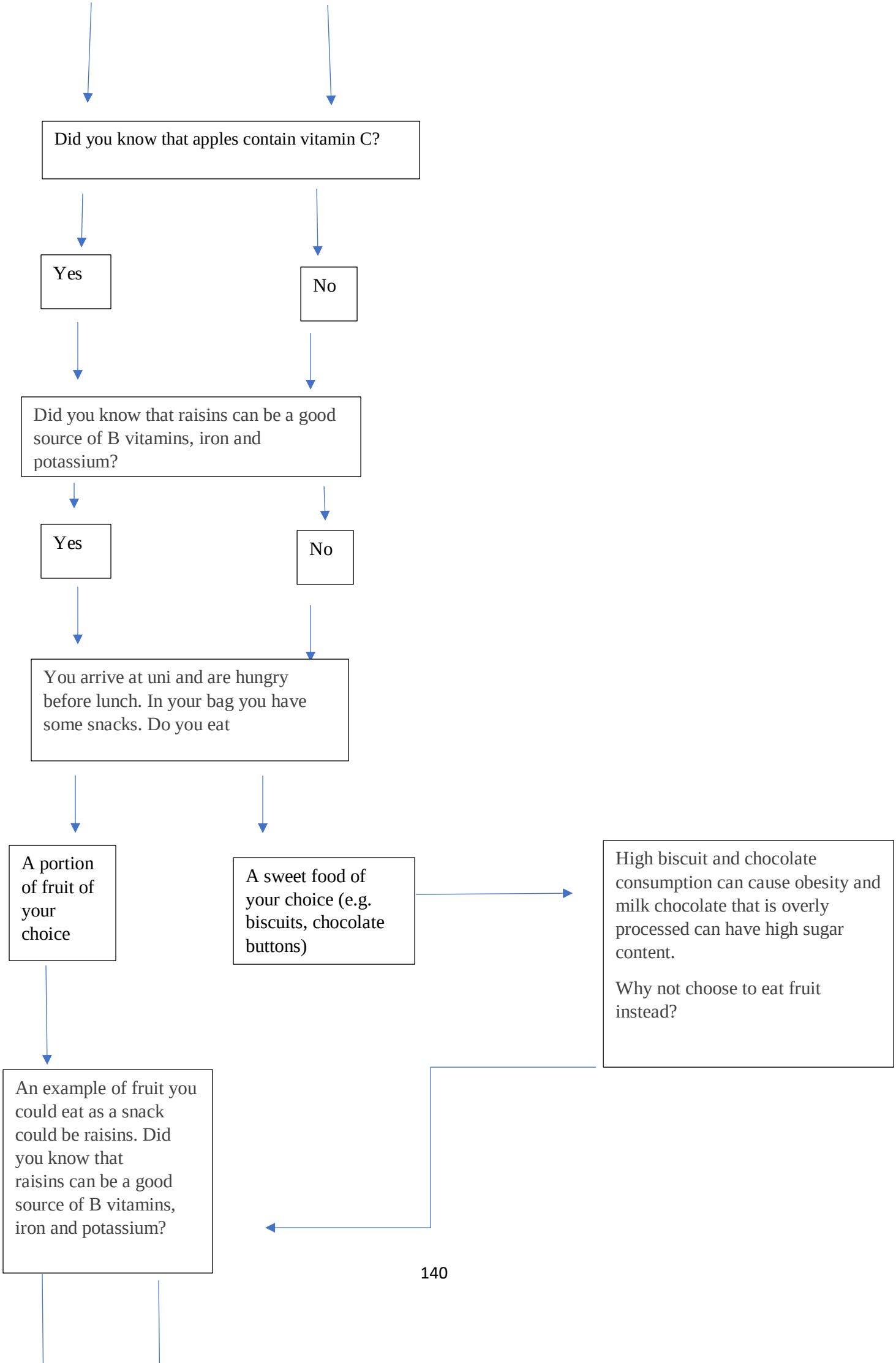
Figure 26: P-P plot of standardized residuals for Model 13.

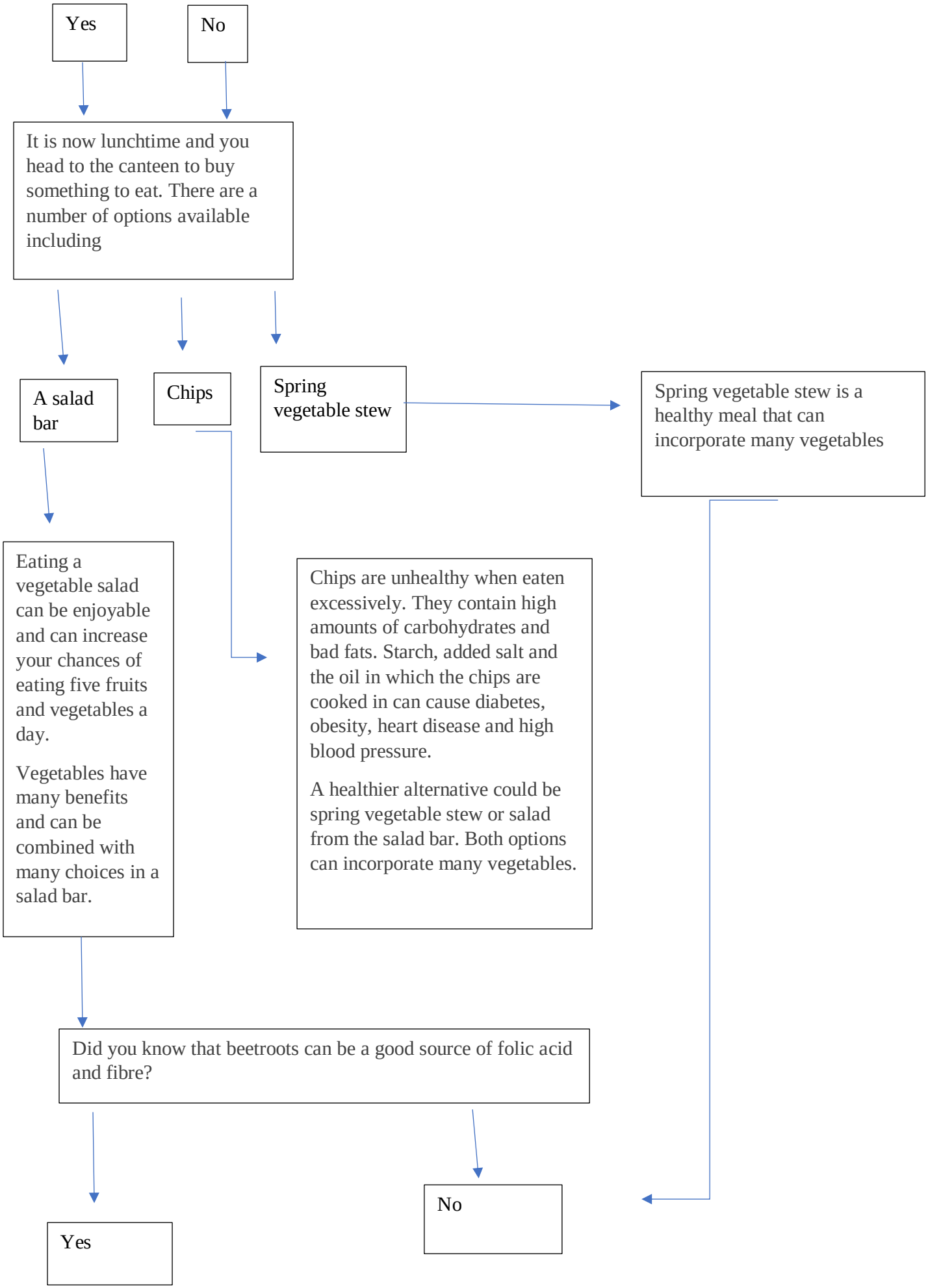


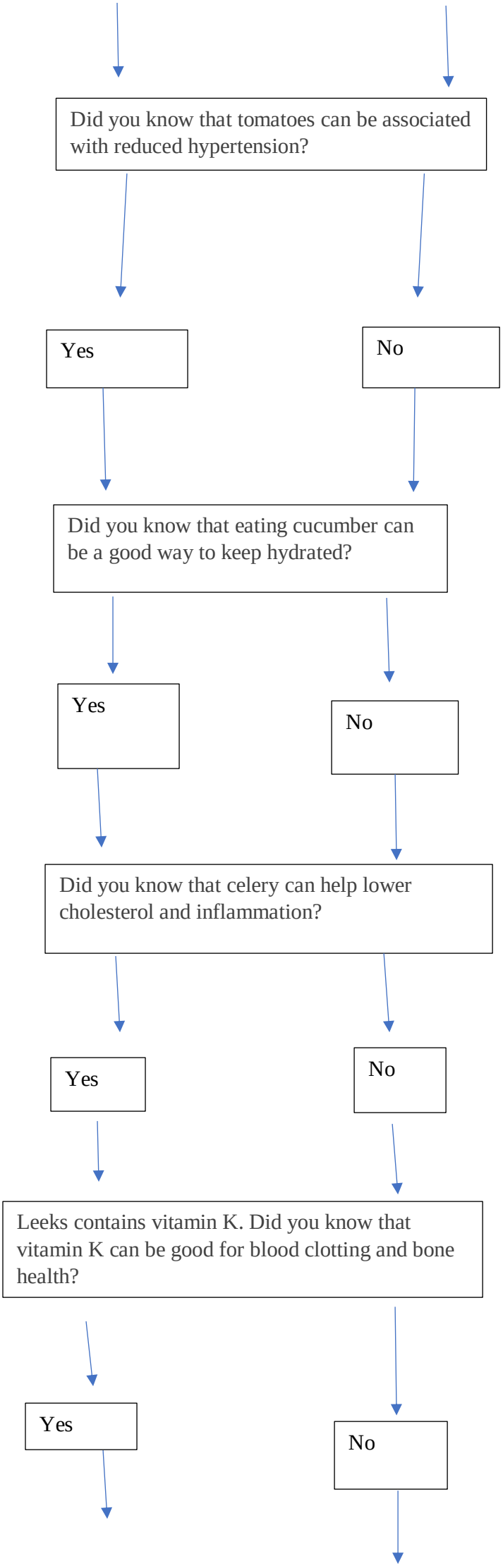
Dependent variable = self-efficacy for FV measured after poster viewing. Independent variables = negative affect measured after poster viewing, positive affect measured after poster viewing and poster message condition (interntion vs control)

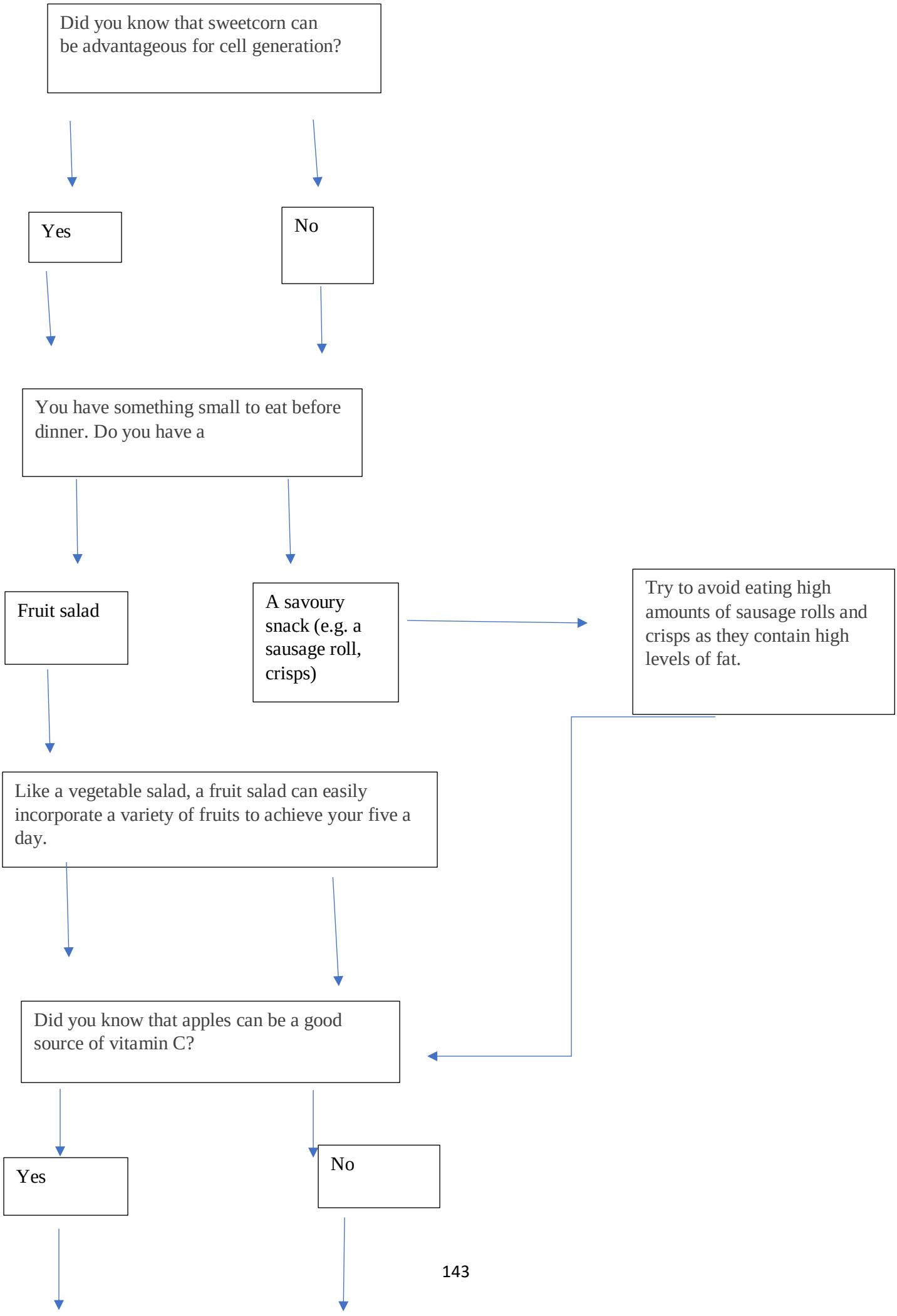
Appendix 6: Flowchart of game tested in study 3.

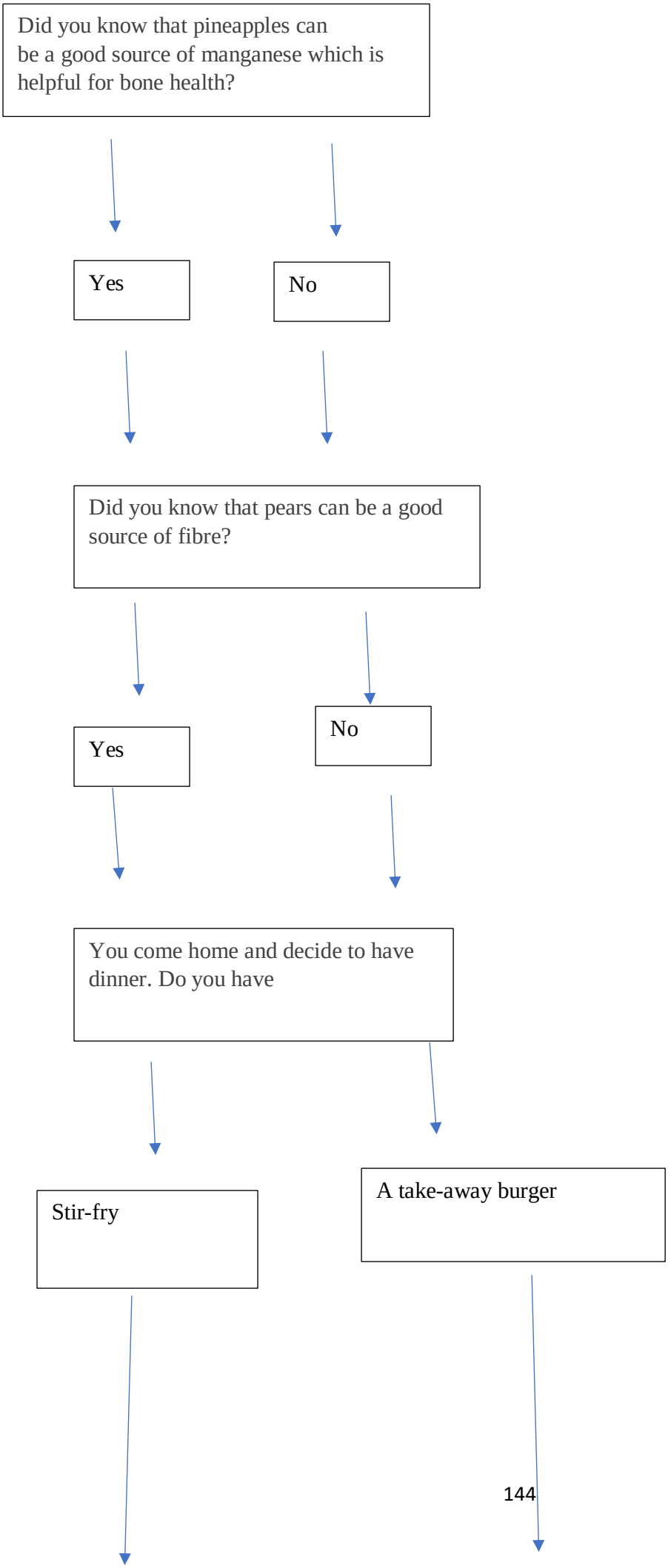


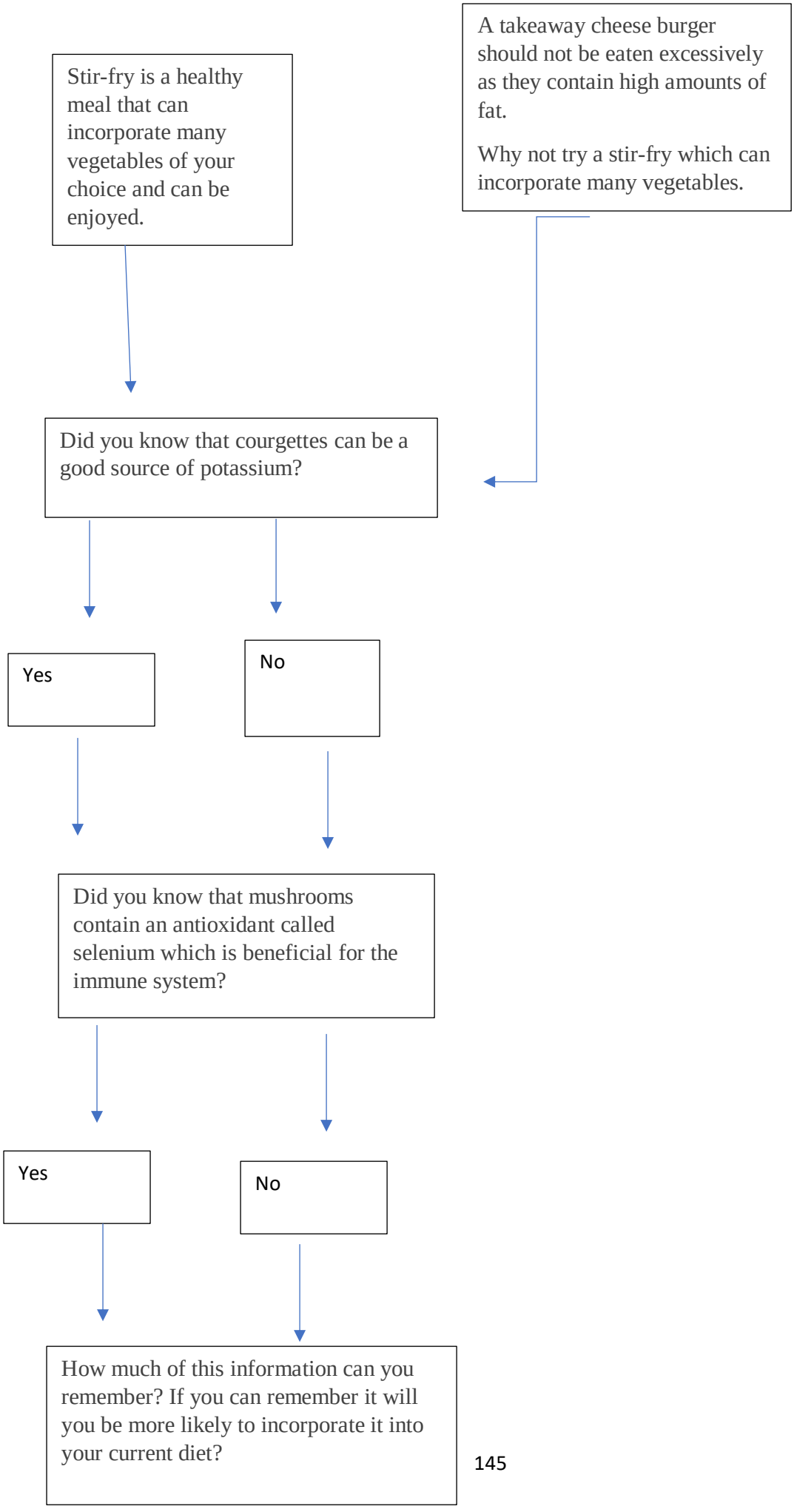

Did you know that apples contain vitamin C?
Yes
No
Did you know that raisins can be a good source of B vitamins, iron and potassium?
Yes
No
You arrive at uni and are hungry before lunch. In your bag you have some snacks. Do you eat
A portion of fruit of your choice
A sweet food of your choice (e.g. biscuits, chocolate buttons)
High biscuit and chocolate consumption can cause obesity and milk chocolate that is overly processed can have high sugar content.
Why not choose to eat fruit instead?
An example of fruit you could eat as a snack could be raisins. Did you know that raisins can be a good source of B vitamins, iron and potassium?


Yes
No
It is now lunchtime and you head to the canteen to buy something to eat. There are a number of options available including
A salad bar
Chips
Spring vegetable stew
Spring vegetable stew is a healthy meal that can incorporate many vegetables
Eating a vegetable salad can be enjoyable and can increase your chances of eating five fruits and vegetables a day.
Vegetables have many benefits and can be combined with many choices in a salad bar.
Chips are unhealthy when eaten excessively. They contain high amounts of carbohydrates and bad fats. Starch, added salt and the oil in which the chips are cooked in can cause diabetes, obesity, heart disease and high blood pressure.
A healthier alternative could be spring vegetable stew or salad from the salad bar. Both options can incorporate many vegetables.
Did you know that beetroots can be a good source of folic acid and fibre?
Yes
No


Did you know that tomatoes can be associated with reduced hypertension?
Yes
No
Did you know that eating cucumber can be a good way to keep hydrated?
Yes
No
Did you know that celery can help lower cholesterol and inflammation?
Yes
No
Leeks contains vitamin K. Did you know that vitamin K can be good for blood clotting and bone health?
Yes
No


Did you know that sweetcorn can be advantageous for cell generation?
Yes
No
You have something small to eat before dinner. Do you have a
Fruit salad
A savoury snack (e.g. a sausage roll, crisps)
Try to avoid eating high amounts of sausage rolls and crisps as they contain high levels of fat.
Like a vegetable salad, a fruit salad can easily incorporate a variety of fruits to achieve your five a day.
Did you know that apples can be a good source of vitamin C?
Yes
No


Did you know that pineapples can be a good source of manganese which is helpful for bone health?
Yes
No
Did you know that pears can be a good source of fibre?
Yes
No
You come home and decide to have dinner. Do you have
Stir-fry
A take-away burger


Stir-fry is a healthy meal that can incorporate many vegetables of your choice and can be enjoyed.
A takeaway cheese burger should not be eaten excessively as they contain high amounts of fat.
Why not try a stir-fry which can incorporate many vegetables.
Did you know that courgettes can be a good source of potassium?
Yes
No
Did you know that mushrooms contain an antioxidant called selenium which is beneficial for the immune system?
Yes
No
How much of this information can you remember? If you can remember it will you be more likely to incorporate it into your current diet?